This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

**Usage guidelines**

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

**About Google Book Search**

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

NEDL TRANSFER
HN 2YCB D

# LONG LIFE

The Occasional Review
of an Investigation of the
Intimate Causes of Old Age
and Organic Death,
with a Design to Their
Alleviation and Removal.

THE LABORATORY
NORWAY LAKE
MAINE

KF 30035(2)

F 16

Discarded by authority of the Andover-Harvard Theological Library

# LONG LIFE

THE OCCASIONAL REVIEW

OF AN

INVESTIGATION OF THE INTIMATE CAUSES OF OLD
AGE AND ORGANIC DEATH, WITH A DESIGN
TO THEIR ALLEVIATION AND REMOVAL

CONDUCTED BY C. A. STEPHENS, M. A., M. D.

VOLUME II

THE LABORATORY
NORWAY LAKE, MAINE
1896

KF 30033(2)

HARVARD
UNIVERSITY
LIBRARY
DEC 15 1961

The Gift
of
C. A. Stephens, M.D.

Copyright, 1896,
by
C. A. STEPHENS.

LIBRARY

4 · '4

ALFRED MUDGE & SON, PRINTERS
24 FRANKLIN STREET

# CONTENTS.

I. THE INTIMATE CAUSES OF OLD AGE (*Continued*) . . . 3
  *a.* Résumé.
  *b.* Further Researches.
  *c.* Multicellular but not Alike Consentient.
  *d.* As to the Final Source of Life.
  *e.* The Problem in a Poppy Stalk.
  *f.* The Nature of the Heredity in the Seed or Germ.
  *g.* Multiplex Impressions and the Physical Basis of Experience.
  *h.* The Dual Nature of the Problem.
  *i.* On the Dispersion of the Germ Elements.
  *j.* Is it Dirt?
II. THE CAPILLARIES IN YOUTH AND AGE . . . . . . 30
III. ON THE CONSENTIENCE OF BRAIN CELLS . . . . . 37
IV. A STILL PROGRESSIVE TISSUE OF THE HUMAN ORGANISM . 50
V. SELF, CELL SELF, AND MULTICELLULAR SELF . . . . 57
VI. LONG-LIVED CELLS AND THOSE WHICH DIE YOUNG . . 67
VII. IS DEATH AN IRREMEDIABLE EVIL? . . . . . . 76
VIII. THE FREEDOM OF THE UNIVERSE . . . . . . . 83
IX. IN RESPONSE TO MANY QUESTIONS . . . . . . 93
X. LABORATORY STORIES . . . . . . . . . . 95
  AN ENTHUSIAST IN TRANSIT . . . . . . . 95
  THE PRESCIENT DISCOVERER . . . . . . . 107
  THE BIO-OSCILLATOR . . . . . . . . 116
  AN IMPASSIONED SOCIALIST . . . . . . . 130
  THE PLATINUM SPHEROID . . . . . . . . 139
  A MERYCOLE . . . . . . . . . . 187
  BLOOD-MONEY . . . . . . . . . 193
XI. THREE HUNDRED LINES OF LUCRETIUS . . . 199

# PUBLICATION NOTICE.

LONG LIFE is the record and exponent of a special line of research, not a literary venture for gain. It follows the progress and fortunes of laboratory work, and for that reason no set dates of issue are guaranteed. It will be printed whenever sufficient matter of interest has accumulated to make publication advisable. Readers may regard it as a magazine appearing at intervals.

Subscriptions to one or two volumes in advance will be received, returnable in all cases where the delay in publication is greater than is satisfactory to the subscriber.

The present price is $1.50 per volume, by mail, post paid.

THE LABORATORY,
Norway Lake,
Maine.

# LONG LIFE.

## VOL. II. 1896.

---

## THE INTIMATE CAUSES OF OLD AGE (*Continued*).

### RÉSUMÉ.

The condition of the tissues in typical old age, and some of the causes which induce organic decrepitude, have been previously noted.

(1) The condition of aged tissue, contrasted with adolescent tissue, in respect to the smaller amount of protoplasm present, and the deposits of non-living earthy matter, resulting from local or from widespread chronic inflammations.

(2) Probable causes of the dying out or binding out of protoplasm in old tissues, and the shrinkage, torpor, and disappearance of the constituent cells; the increased rigidity of the blood circulatory apparatus and the lowered dynamic coefficient of the muscles, particularly the heart muscle.

(3) The slackening or deadening of the general bodily sense in the aged, due to the quantitative decrease of protoplasm in the organism and the relatively increased amount of "formed matter."

(4) The evidences that old age and death from general organic impairment are due to the cumulative errata of life, as at present lived, errata from imperfect food, physical injuries, bacteria, etc., rather than from any general law of death, or the slackening of the intimate sources of life in matter. In a word, that old age and death occur from essentially common causes rather than from any law of nature; and that the elements of life in matter are eternal.

"Each and every one of the causes of old age and death is of the nature of an ordinary physical cause fairly within human power to remedy, and many of which we are every day remedying. It is the sum total of these causes which has heretofore rendered death a seemingly inevitable sequence to life.

"Death comes to us not from a law of nature or matter. The law of nature is life rather than death. Universal matter lives from eternity. It is a sentient substance; and this, its elemental sentience, is indestructable, deathless; a constant in nature, even as its co-relative, gravitation, is a constant. Matter never dies, not even the least particle of it, but lives immortally. Life is therefore the grand law of the universe from age to age.

"Here on this eternal constant, the intimate life of matter itself, may be founded the hope of a possible terrestrial immortality for the descendants of man. No vicissitude of earth has yet been observed to abate its quality. Everlasting as the stars, it shines forth from the core of every ultimate particle of matter and illumines the wide deserts of space with the glow of life and feeling."

The conception that immortal life may be achieved by applied science, first put forth as a practicable idea in 1888, has borne the brunt of great dissent. Most adversely has criticism — biological criticism — been levelled at the grounds then taken, to wit, that old age and organic death are due to the cumulative errata of life, rather than to any mortal law inherent in living matter, which periodically limits life to a more or less definitely fixed "lifetime."

## FURTHER RESEARCHES.

In the light of more recent research, these positions, as above, while not controverted, require certain modifications.

For example, protoplasm, meaning the cytoplasm of a cell, can no longer be regarded as a homogeneous substance of fixed vital coefficient, but as a variety of substances, irritable, contractile, sentient, adapted to the life and wants of the cell. The cell is a small organism, having within it what corresponds in some degree to muscle, nerves, blood, bone, and assimilative tissue. It is a little organism within the larger animal organism. The cell contents have been variously differentiated to the wants of the cell life, even as in the multicellular organism, tracts of cells have been differentiated to produce the necessary organic tissues, muscle, nerve, bone, etc.

What is true of the cell is also true in a degree of the cell nucleus; and, at present, histologists are concerning themselves with still more minute bodies within the nucleus which appear to direct nuclear development. The conclusion is reached that, in ultimate analysis, the cell is also a somewhat complex organism, having a personal axis of being and living by virtue of complex chemical activities, presided over by a small subjective personality.

When this deduction had obtained biological sanction, it was easy to picture the human organism as composed of several billions of cell lives, and as built up from the products of cell growth. The human intellect, we were led to conclude, was the sum of the cell sentiences. For a number of years the opinion prevailed that a human life must needs be what the cells *were inclined* to make of it; and that the cells were the final court of appeal. The sentience or intelligence of a cell was held to be of the same intrinsic quality as the intelligence of a man. The development of the animal organism was studied as a growth, directed rather by cell sentience than by a personality which had been evolved from it and risen to a higher order of intelligence.

There was a great deal of hopeless fatalism embodied in this view of cell autonomy, which strongly tinged biological writings for a number of years.

But presently the more acute observers, particularly certain embryologists, began to revolt from this foregone supremacy of the cell life over organic life, and to point out that although the cells form the animal organism and constitute the sentient basis of intelligence, there is developed from their sentient aggregation a personality, not only greater quantitatively, but of a higher order, which is capable of reacting dominantly on the cellular service from which it arises, of regulating that service and largely directing, moulding, and bending the cells to the needs of the higher personality.

In the human brain, where personal life and mind reside, from sixty to seventy millions of cells are found united by a most remarkable system of protoplasmic processes in an organic entity; so sentiently connected one to another by emanent living threads and filaments throughout the cerebral and cerebellar masses, as to form a consentient organ in which a personal axis is set up.

What the student of the minute anatomy of the brain discovers here is not a mere herd of cells, a democracy of cell life, but an organ in which cells have been forced to grow and put forth enormously extended processes, not natural to the life of separate, isolated cells, in order that an organic union may be developed of which the sixty or seventy million component cells are but as bricks in the walls of a grand edifice.

Not the individual will of the separate cells develops this amazing structure and directs this architecture, but the personal intelligence of the increscent organ itself.

Throughout the embryonic period, from segmentation onward, cells are seen to be moulded and collocated by a power not pertinent or personal to the cell life, *per se*, but which cannot be described otherwise than as the embryonic personality.

How this embryonic personality is embodied, whether in the centrosome, or "attraction particle," so called, is not well known as yet; but it is present and thus early evinces itself the youthful regent of all the component cell life.

In the internal economy of the life of a cell, too, we find similar conditions prevalent. The protoplasmic molecule appears to be to the cell what the cell is to the animal organism, namely, its structural unit of development. From the lowly sentience of this complex molecule, the higher sentient life of the cell is developed. But even what we at present know of intracellular structure is sufficient to show that the molecule has been made the instrument of this larger cell life, rather than that the cell life is a passive resultant of molecular autonomy. From the fission of an infusorial cell onward throughout its individual existence the evidence is conclusive that the cell life as a whole directs the arrangement of the molecules and makes them subservient to its small will. From the moment that such a group of molecules are united together, a consentient personality is established. The sentience of the individual molecules is surrendered or pooled in a new higher order of sentience, which hereafter directs the unified mass. Such a cell is something more than a republic of molecules. It is an organization, the sentience of which is raised to a higher rank.

It is not otherwise with the cells of the animal body and the grander life which arises from them. The animal organism is to the histological cell what that cell is to the protoplasmic molecule. This ascendency and this dominant influence of the organic whole over the component units will be more fully set forth in another paper of this issue. It is sufficient to say here that the point in biological research has been reached when we can declare ourselves free of that old bondage to the cell which, for the last quarter of a century, has rendered human progress dubious.

This is of itself a great advance. It breaks a shackle of fatalism which many materialists were inclined to impose on all hopes of future human evolution. It opens the gate to a self-reliant progress. The dominant power in the human organism is the personal life, not the lowly wills of a herd of cells.

Not that the cell doctrine, as put forth by Schleiden and Schwann, is to be regarded as controverted, but as modified. The animal life, or personality is, indeed, dependent for its subjective being on the aggregate sentience of the component cells. Biology, however, now looks upon this aggregated sentience, not as the personality or intellect of a human being, but as the sentient basis merely from which the intellect has been developed; and that this personalized intelligence has long ago surpassed the domination of the cell, established a personal axis of its own, and even usurped the cell autonomy. In sleep, alone, is the cell autonomy resumed. During waking hours, the cell life is the well-nigh abject vassal of the animal intellect and will.

From the latest dictum of biological research, therefore, we must regard the human organism as developed, existent, and surviving by virtue of the human personality, descending from parent to child; that this personality has reactive energy to modify and improve the organism.

Parent and child, indeed, through a hundred generations, are in a sense but one human personality, pressing forward, in time, to become something better, wiser, and more powerful. The parent dies and the child succeeds, at a vast loss of knowledge and of time, not because death and birth are the ideal or ultimate laws of life, but merely because we have not yet acquired sufficient knowledge and power to escape death. The human personality, incarnate, living on from century to century, conserving science, able to renew himself and resist all the vulgar agencies of decay and death, is the ideal human being, not a chain of parents and children.

But life, as we now live, is one long contention with accidents, bacteria, improper food, duress of climate and hostile fellow-creatures. First the cell was driven to a mode of reproduction, to escape extinction; multicellular creatures developed from cells and may be said to have inherited the reproductive mode of life. Humanity has arisen from its lower ancestry to its present estate, by virtue of the reproductive mode of life. Hence, to die appears to many persons to be as natural a fate as to be born; yet when more closely examined, death is seen to be a wholly unnatural event, a result of hardship and distress, a fate repugnant to life everywhere, and a catastrophe to be escaped.

## ON THE EXHAUSTION OF THE CELL NUCLEUS.

Among the intimate causes of old-aging may here be mentioned one which has been given a fanciful prominence, during the last five years. I refer to the supposed exhaustion of the cell nucleus, after a definite period of development. It has been held that the nucleus, as a vivific centre, becomes exhausted as organic life continues; that the apparent senile shrinkage of the cell results from this nuclear exhaustion; and that the organism merely reflects the " aged " condition of its consentient cellular elements.

This hypothesis is a legitimate deduction from the cell doctrine as held by those who have taught that the human organism is simply what its constituent cells elect to make of it, and is part and parcel of the fatalism embodied in that doctrine.

Prolongation of human life, under this theory, is a question of cell husbandry, of reducing vital expenditure to a minimum; in a word, of living economically, frugally, scrimpingly, in order to make this modicum of vital capacity, inherited in the nucleus, last as long as possible. According to this view, the capacity for life which the nuclear body possesses is a fixed quantity which by no effort on the part of the organic life can be added to. It is an inherited, non-interest-bearing, vital capital which we expend in living, and to which nothing can be added by the individual. By good husbandry life may be prolonged till this inherited, vital capacity is used up, but no longer. Inevitably we come to the end of it.

This is a doctrine which possesses a great fascination for minds of fatalistic bias, and has been set forth in various scientific publications. The subject will be treated more in detail along with the theories of Weismann, the researches of Maupas, and the opposed views of Whitman, Wilson and many others, under the head of " Long-lived Cells." It is sufficient to say here that the nuclear exhaustion theory of life contains no recognition of the human personality as a directive agent in the development and maintenance of the organism, but treats of it merely as a non-reactive product of cell growth.

When we ask the question broadly, why does the human body grow old and at length cease from function, putting the inquiry in the bio-physical sense, the answer is that the personal life embodied in the organism is at length overcome and overmatched by the totality of the resistance to life which it encounters, from the embryonic stage onward. More specifically, to the general telluric resistance, physical, chemical, molar, molecular, which the protoplasmic molecules of the organism meet with, as long as they maintain the personal life. After adult age is reached, they lose ground in the struggle and at last succumb. But there is a period, during adolescence, when they gain ground, when they make head against the terrestrial resistance to life and prevail joyously, with a sense of victory; when the inherent energy of the personal life is more than sufficient to breast the opposition.

We have, therefore, to picture this personal life as a bio-physical impulse which for a time rises superior to the resistance, then slackens and falls away to cessation.

Yet its source in matter is apparently a constant in nature, inseparable from the material atom, and persistent in matter at a uniform tension. Why then, in the human organism, is it exhibited thus intermittently, as "wave motion"; in adolescence and senescence; in youth and old age?

The answer is that human life, even as waves on the ocean, or sound waves in the air, has fallen into the rythmic, wave mode of life, as a general result of the terrestrial resistance to life; and that the cessation of vital energy, seen in aging organisms, is apparent rather than real, marking a transfer of life from one generation to another.

The transfer of life by means of the reproductive elements and the subsequent death of the parent organism is a mode of life into which all animal orders fell far back among the earliest metazoans, if not in unicellular life itself.

It is manifest, too, that this tendency or life habit of humanity is very deeply rooted in the cellular elements of our being. Sterilization of the reproductive tissue in the individual, removal of these tissues, or the most rigidly enforced continence, has little or no effect as regards the aging and death of the organism. The tendency of the body to follow its inherited cycle of growth and decline is inveterate, and not to be changed by the exercise of the will. Something, indeed, this will power of the personal life may effect, but not that radical transformation of being which the perpetuation of the individual implies.

Procreative desire rapidly slackens in individuals to whom life offers sufficient attractions to live on for life's higher, more refined pleasures; and in this circumstance we have a certain earnest of evidence that the higher intellectual life of the future will physiologically redound to a prolongation of individual life. Decline of the procreative instinct follows naturally when the patient has hopes of surviving; and such decline and self-continence react to prolong life; yet centuries would scarcely suffice to alter the deap-seated trend and course of our ancestry.

It is to our sciences that we look to aid us in prolonging our lives, not to the slow reactions of the cellular basis of our lives. Man has already passed the point where he relies, for his progress, on the tedious course of unassisted nature. He reaches forth a Promethean arm and, in the light of his stores of knowledge, bends nature to his wishes. We expect to bring our sciences to act upon this cellular basis of our lives and accomplish its regeneration.

Under nature man would never surpass the purely animal cycle of organic growth and decline; of adolescence, maturity, and old age. It is only by rising superior to the ordinary course of terrestial nature that humanity has become something more than an animal order of life, recording his experience in written language, kindling fire, smelting the metals, impressing the lower animal orders into his service, and even dominating the forces of nature, in order to travel by steam and speak around the globe by electricity. He has put nature in harness and now controls natural law.

In view of these grand victories, why should he despair of altering the ordinary course of nature in his organism and of directing the life of the cells of which his tissues are composed? The question is a novel one, in this sense. Hitherto, biologists have assured us that we must be content to be what our inherited cells would make us. That is the old cell doctrince, in a nutshell. Weismann and, in general, the German and English histologists base their theories of life on this assumption, namely, that the ordinary course of nature must be final as to man's future. Nature is fate.

But everything which makes man a civilized and enlightened being has been obtained by the arbitrary mastering of nature and the diversion of her ordinary courses to his advantage. Why should we not expect to thus arbitrarily change and facilitate the nutrition and life of the cell? In point of fact, that is what has been done and is being done constantly in a hundred ways already, although many biologists seem to ignore these innovations on the mode of nature. The position of not a few biologists on this question, to-day, is much as those who would argue that since a man can walk but fifty miles in a day, afoot, by his natural means of locomotion, or swim but twenty miles, he can never go to San Francisco in less than sixty days, or reach Liverpool in less than five months.

It is to science that we look for the control of cell life. Biological science, it is true, is still in its infancy, but it is a very hopeful infancy, and it is the opinion of many of its best exponents that within another quarter of a century we shall have penetrated the secret of cell nutrition and growth, and opened the way to an artificial renovation of the tissues.

At present we are slowly working our way toward such discoveries by means of the approved inductive methods, and dealing with the proximate rather than the intimate causes of old age and bodily decay. There seems to be no better way as yet. We lack in data which at best can be but gradually accumulated, and have to contend with widespread unbelief, even among scientists. Faith has to be engendered as well as discoveries made. Enlightened man, indeed, is but just awakening to the idea that he may possibly escape death by setting his wits to work to this end; and, as ever, there is the olden outcry of impiety raised against the conception, as if it were wrong to try to live!

To the proximate causes of old age and death, as well as the ultimate causes therefor, this investigation is at present directed.

For example, we see that in certain of its aspects old age resembles a slow starvation of the cells in the tissues; they are badly nourished; the blood furnished to them is deficient in properly assimilated and sufficiently oxygenated particles; the capillary channels are obstructed by waste matter; sufficient oxygen does not penetrate the alveolar walls to maintain the proper degree of bodily heat.

There is, moreover, what may be termed general disorganization, in this sense, that the various organs which labor together to make up the organic whole and support the personal life, at prime, begin to fall out of the co-operative effort, as regards the products which they yield. The gastric and intestinal glands and crypts produce altered, inferior juices; digestion is less effectively completed. The liver, pancreas, kidneys, spleen, *et al.*, fail to properly eliminate waste and poisons. One or another fails markedly, and that unity of action which we term " constitution " weakens or is disordered.

From alterations of the cells of certain epithelial surfaces, as, for example, the nasal meatuses, posterior nares, cyst, bowel, *et al.*, veritable ptomaïnes begin to be produced in place of proper products, which constantly act to depress life.

The circulation of the blood, too, is less rapid and efficient, both from the decline of contractile power in the heart muscle, and also in the walls of the arteries and arterioles. At prime, the entire quantity of blood should make the circuit of the organism and pass through the heart in from twenty-three to twenty-eight seconds. In age, we find this circulatory period considerably lengthened, and this loss of time, in conjunction with lowered respiration and smaller ingestion of oxygen, tends disastrously to lower the organic heat.

The consequences of this loss of heat become more significant when we take into account the fact that the cells of the central nervous system cannot continue in function when the body heat falls much below 98° Fahrenheit. In old age, there is a constant struggle to maintain this requisite degree of bodily temperature. Not a little of the sluggishness and torpor of faculties in aged persons is due to lack of vital heat. The cerebral cells and their immensely prolonged protoplasmic processes cannot fully act to produce alert self-consciousness and memory, if even the established standard of temperature is reduced by one degree. Such is their control over the organism and their power to draw the oxygenated blood to their uses, that in their effort to maintain the personal life, vested in them, intact, they drain other organs and parts of the body of heat, conserving it at the brain, in case of caloric shortage. Hence in the aged we constantly find cold feet and nether limbs, cold hands and chilly gluteal tracts. The central nervous system is conserving the scanty heat supply to itself, and this of direst necessity, in order to sustain personal life and self-consciousness. In this sense it is that the aged often die of cold and starvation.

It is not claimed that these phases of the aged condition are in any sense the intimate causes of that condition. Rather they are consequences, yet consequences which combine and act together to accelerate infirmity and death.

Hence each and all of them are proper objects of our investigation with a view to their amelioration. The intimate causes are involved in the cell and its ancestry, and in the plan on which the personal life of a human being is now developed. Discoveries and inventions may and undoubtedly will enable us in time to act directly on the histological cell; but at present we find that the best progress may be made by collecting data concerning the proximate causes of aging. For example:—

*a.* The condition of the capillaries in age as contrasted with prime, or adolescence, since the blood circulation is here a factor of great interest.

*b.* The condition of the cerebral cells at prime as contrasted with the aged condition. Also parallel studies of vegetable cells in young and in age-stiffened plants after florescence and seeding.

*c.* More exact determination of the constituents of old and young blood, in connection with abnormal substances of the nature of poisons found in it in aged subjects.

*d.* Comparative examinations of the tissues of aged and adolescent subjects, from every organ of the animal body, to learn broadly what the differences are and whether certain organs have a tendency to age more rapidly than others and by their earlier decline to drag down their associate tissues.

*e.* Psychical studies of the mental condition of old and young persons, comparatively, as regard the decline in hopefulness and ambition which characterizes advanced age, as marking a cycle of growth and decline of the personal life in the cerebral tissues.

*f.* Observations of the bio-physical effects where new hopes and new ambitions have possessed the intellect, from changed fortune, as showing a potential capacity for a more extended development of the personal life.

These suggestions merely epitomize what appears to be at present a promising line of research for the accumulation of data for future use. As yet we have little that is exact or reliable on these subjects. It would appear that our inquiry must be pushed both from the subjective and the objective stand-point, from the psychical and the physical side of the personal life. For example, it is manifest that men die at the age of three or four score years, quite largely because they believe that they shall thus die and from childhood have developed mentally in that belief. All their objects and aims in life have been planned, nurtured, and limited to accord with such an expected lifetime. We mean to intimate from this that if children, or an isolated group of young persons, were assured in advance that they were to live for a thousand years instead of eighty years, a much different intellectual development would ensue in them,—one which would redound greatly to prolong life. It is not to be supposed that such an assurance, however well credited, would at once suffice to stem the tide of cell heredity; yet it would act to that end, much more powerfully, we think, than is generally believed. Prolonged life will come largely as a result of the faith that prolonged life is possible. To live long it is necessary to entertain an expectation of it early in life, and develop intellectually on such a plan. The idea intended to be conveyed is that the subjective or psychic side of our being must take the lead in such an achievement; and that its efforts must be seconded by the assiduous application of every discovery of science.

### MULTICELLULAR, BUT NOT ALIKE CONSENTIENT.

To gain a practical conception of the causes of old-aging, one must first comprehend the composite nature of a human life and the relationship, one to another, of the various tissues and organs of the body. We are in the habit of regarding the organism as a multicellular one, and so it is; but it is something more than that; something more involved than a mere assemblage of consentient cells. The problem with which we have to grapple is much more complicated than this common conception of it would at first lead the student to suppose. For the personal life and intellect does not inhere alike in all the cells, but only in one specialized tract, or group of cells. This special cell tract, according to the best observations thus far made, is not in continuous protoplasmic connection with other cell tracts and organs of the body, but acts on them, secondarily, by means of insentient agencies.

This specialized cell tract, constituting the organ of the self-conscious intellect, is, of course, the brain and nervous system. It is a distinct group or species of cells, lodged in the fabric of their special products, and is the sole and peculiar tissue of the personal intellect. The cells of this group or tract are in sentient, protoplasmic contact one with another, and by means of such actual contact or touching together of the cell appendages, are able to live together and feel together as a unit — an ego.

This unification does not extend, at least not in any appreciable degree, to the cell groups of other tissues and organs of the body, nor include them within the cordon of the consciousness.

On the contrary, the nerves act on the muscles, glands, bones, liver, spleen, lungs, epithelial tracts and skin by means of specialized apparatus and agencies akin to electricity, in place of direct sentient contact. The muscles, skin, bones, and enteric organs are therefore, in a sense, foreign groups of cells whose sentient life does not blend with the intellect proper. Rather, they are in the condition of subject provinces of an empire, the capital and directive head of which are in another quarter of the globe.

It is necessary to keep this fact constantly in view in dealing with the causes of old-aging; and it greatly complicates our problem.

For all these subject provinces of muscle, bone, cuticle, and enteric tissues constitute so many groups or tracts of cells not within the sentient bond or union of the brain group, and having each a certain autonomy and individuality of its own, developing, too, and declining, each according to its own inherited capacity for life.

Yet even more than we have previously been in the habit of believing, all these subject tissues are regulated, held in line, and maintained in activity by constant currents of *stimulus*, of the nature of electric currents, from the unified tract of cells in the brain and nerve system. Cut off from these currents which maintain their activity the cells of the stipendiary tracts and organs relapse into disorder or desuetude and soon perish. This fact has been well established by recent experiments and is also made evident in paralysis and paresis. The more intelligent of our medical men have therefore come of late to recognize an intrinsic difference between diseases of the nervous system and those of the subject organs of the body. It would not be inappropriate, indeed, to classify all diseases of the nervous system as primary diseases and those of the remainder of the organism as secondary diseases, so many of the latter result and originate in the former. In fact, nearly all the diseases and affections of the subject tissues and organs of the body which can be correctly classed as primary are the invasions of bacteria, accidental poisonings, and those cases where an affected organ, like the liver or lungs, deranges some other organ, or damages it with abnormal products of the nature of ptomaïnes.

We have therefore to discriminate specially and regard as of distinct and primary importance the defects, diseases, and secular decline of the cells of the brain and nervous system, for these are personal to us; those of the other, associate organs are impersonal and in another category.

## AS TO THE FINAL SOURCE OF LIFE.

Months have been spent at this laboratory, with the aid of very high microscopic powers, in the examination of the cell — cells from every tissue of the human body; embryonic cells; plant cells; bacteria — in the hope of reading its secret, of divining the source of life. Some vital, vivific point, it has been thought, must exist within the nucleus, whence life radiates or is reflected outward, as matter-moving power; some "biophor," some "physiological unit" of Spencer, some royal little monad of Leibnitz, some molecular *regulus*, or biostatic corypheus, which the much-assisted eye of the skilly man might, by long watching and a grand patience, succeed in expiscating.

The throes and labor of the parturient cell have been observed, its curious condensations and separations into "pole bodies" and "nuclear spindle," till lo! the new cell is extruded before our eyes. If we could discern the molecules, rallying, contending, and parting, should we find there anything more significant or explanatory of life itself?

How old an author said, "Can a man by searching find out God?" But it is in the spirit of modern science to reply, "Perhaps, if we look long enough and in the right place."

Then suddenly, after long scrutiny, it occurred to me that I was not looking in the right place for the source of life in the cell. That if I possessed the highest conceivable power of amplification, an objective which would magnify molecules to the size of Satsuma oranges, and primeval particles (if such exist) to the size of mustard seed, and could mark the movements of each and every one of these, as the cell reproduces or builds tissue, or *thinks*, I should be neither nearer the goal, nor farther on my quest for the Holy Grail of life.

And why?

Because it is not there.

But where then?

Everywhere. From the entire universe. From out waste places and the uttermost parts of cosmos. Life is the general effect of the Whole on the smallest part. Each smallest particle is potentially sentient because of the coercive influence of the Whole. Each smallest particle is an "I am," but an inert "I am," and would remain so but for the retro-active summons of the Whole. When conditioned in the protoplasmic molecule, these smallest particles are able to respond to the summons in self-movement which we term vital. The large protoplasmic molecule is intra-mobile. The potential sentience of these smallest particles is what enables them to respond to the call of the Whole; they first feel, then move. The macrocosmic invocation, the summons to live, is issued from all external matter across the abysses of sun and star; the ability to respond is the elemental endowment of the particle.

Not in the nucleus of the cell, then, nor in its most esoteric penetralia will the source of life be discerned; not in one particle of matter, here or there, more than another, will *bios* be located, isolated, or eliminated. It is the great Voice from without which falls on the sleeping ear of the terrain particle and wakens its sentience; wakens it to the day-life of vital activity.

## THE PROBLEM IN A POPPY STALK.

When we regard the growth, blooming, and death of a summer flower, the shooting upward of the flower stalk of a poppy, for example, with its blossom, its seeding, and its suddenly ensuing juicelessness and dead rigidity, we contemplate phenomena not wholly unlike what take place in the human organism, when regarded in the large.

What has taken place in the poppy stalk?

One class of plant cells has developed and by the products which have issued from them has produced the stalk proper and leaves. Immediately another class has, in like manner, given rise first to the bud, then to the gorgeous blossom with its stamens and pistils. Fertilization follows in its timed order; and later another class of cells matures as seed.

It has been held that these latter cells in some manner sap and eviscerate, so to speak, the cells of every other tissue of the plant, and thus sapping them of their life elements or germs, condense these latter in the seed, where it may long lie dormant, yet capable of producing another plant; and that the parent plant, thus sapped and eviscerated, dies naturally, its life being virtually taken away and carried forward to the seed for another year.

The observed fact that the root and lower leaves of the poppy remain green till late in the season, if the flower stalk is nipped, has been regarded as evidence of this view, namely, that the phenomena of its growth, maturity, and dry death stand for a precession, successively, of one class of cells before another from the seed around to the seed again; that the plant dies when the germs of life have left the stalk and leaf and passed upward to their final lodgment in the seed.

It is an easy theory, easily derived, easily argued, and falls in superficially well with the cell doctrine and with current theology.

In an obtuse sense, it is true, too, yet carries a great untruth and, argued to its outcome, is a vicious Weismannism; vicious in that it would seem to indicate that the ultimate object of all plant life is to bear seed; of all animal life, to bring forth offspring.

*Per contra*, we believe that the object of all life, vegetable and animal, is to LIVE; and that seed and offspring are produced because under the hard conditions of the earthly habitat, we are unable to live on continuously. That is to say, if the earth had always been an easy habitat for life, there would have *been no seed, no offspring, no death*. Offspring and seed result originally from hardships and prospective death to the parent cell, and are not the object of living, but rather an evasion of death.

It seems to me very desirable to have these premises right at the outset as contrasted with the contrary view, and to set off free from a radically wrong and pernicious theory of life, which has so badly muddled biological discussion during the last five or six years.

To return now to our observation of the poppy stalk, whatever of fate, of final tendency to go to seed, there is in it will be found due to heredity, established by long conformity to climate and other conditions; a habit of living which leads the different classes of cells to develop and produce tissue at a certain time, relatively to each other; and in the manner in which these different tissue growths of the stalk and flower limit and restrict each other.

It is now more than doubtful, and is discredited, whether anything of the nature of a migratory germ, or " biophor," ascends from the tissue cells to the seed, and is thus transferred from plant to plant and year to year.

### THE NATURE OF THE HEREDITY IN THE SEED OR GERM.

Granting the general truth of the doctrine that seed and death result primarily from the hard conditions of terrestrial life, which make it impossible for metazoans to live on continuously and deathlessly, it has been argued that all existent forms of life have fallen irretrievably into the mode of living and dying, as seen in plants and the lower animal orders.

Not only do the same conditions of hardship and limitation still prevail which first induced seed and death, but every plant and animal lives by virtue of, and in accord with, a plan or an arrangement of the germinal matter in the seed, which compels it to unfold as did the parent, and inevitably produce seed and die.

That is to say, the arrangement of the protoplasmic molecules in the germ, seed, or ovum is such that the successive growths of tissue must, if the plant or animal is to live at all, succeed each other according to the order of their arrangement or garnering in the germ.

In the main, this view must be conceded to be upheld by the facts. Heredity does thus hold all forms of life within its iron clutch. Plants and the lower orders of animal life tend not to change, and for the most part would perish if suddenly altered conditions compelled great changes; and it is but to a single tissue, even in the human organism, — the cerebral tissue, — that we can look with any confidence for a successful contest with the restrictive dominion of heredity. That one tissue is still progressive and has always been so, capable of self-direction and self-elevation.

### MULTIPLEX IMPRESSIONS AND THE PHYSICAL BASIS OF EXPERIENCE.

An hypothesis of the old-aging of the nervous system and cerebral tissue of man has been advanced from the progressive effects of continuous or oft-repeated mnemonic and sensory impressions in the protoplasmic substance of the brain and minor nerve centres.

Memory, experience and the growth of the intellect depend on impressions from the external world which come to the brain through the organs of special sense and the general sensibility, and remain there as pictures. Such impressions, or pictures, are believed to be physically inwrought in the sentient substance by something akin to chemical activity, and, as is well known, will remain there mentally recognizable for many decades. From such portraiture of the external world, physically impressed in the material substance of the brain, we have what is commonly termed experience. This experience, however, is something more than an accumulation of impressions or pictures; for it is accompanied by the formation of opinions and intellectual growth. There is assimilation of the collected data as well as mere accumulation; growth of the garner itself into an organic sentient whole.

None the less, the brain is literally bepictured with mnemonic imagery, its substance being arranged, moulded, or stamped with it to such degree that a recent writer has not hesitated to define the "soul" as "the form of the organism."

It is a well-known fact, moreover, that the frequent repetition of the same impression, as of sensory experiences, scenes, and sounds, has a marked tendency to dull our sensibility to them. Equally well observed, too, is the loss and confusion of memory in advancing life.

Hence the hypothesis, namely, that the constant repetition of impressions and the continuous bepicturing of the brain substance with mnemonic imagery has its natural, physical limits which cannot be long outrun without utter confusion and blurring of the material medium, as when one picture is printed upon and over another. The inference derived touching long life has been that a lifetime greatly exceeding seventy-five years must of necessity result in mental dulness and confusion of thought.

Data as to the ultimate capacity of the brain are wholly wanting. Thomas Parr, at the age of one hundred and fifty-two, is alleged to have been "bright" and normal as to "all his faculties." Henry Jenkins, of Yorkshire, England, "distinctly remembered" the battle of Flodden Field, fought one hundred and fifty-seven years previously. Robert Evans, of Spitalfields, "clearly recollected" the execution of Charles I., one hundred and thirty-two years before.

What is known as to this subject of brain capacity, for experience and for memory, goes to show that if the data of experience are normally assimilated with one's existent knowledge and incorporated as such knowledge in the mind, no confusion will result from their progressive accumulation.

In the aged, recollections of youthful years often appear to be revived and to grow vivid, although it is a matter of common experience that our memory of past events fades with the lapse of time.

## THE DUAL NATURE OF THE PROBLEM.

Whatever may be predicated of the monistic or unitary conception of matter, considered as a final hypothesis, the fact remains that at present — at our present working distance from the ultimate particles of matter, if such exist — we have to regard matter and deal with it as a dual thing, as a substance and an energy, in union. This union is, so far as any test which we can yet give it, an indissoluble one; and since a living plant or animal is the most full and most perfect illustration of matter and its properties, we have been led to take the grounds that matter must be portrayed as substance and sentience combined.

From the objective stand-point, life, the life of any living creature, is so much energy. It becomes something else to us only when viewed, or rather *felt*, from the personal or subjective stand-point. Then, indeed, it is our self-sentience and intellect.

Hence, we conclude that the energy, or power, which each and every particle of matter is seen to exhibit, is to that particle its life, its sentience; and that this life of matter becomes progressively consciousness, self-consciousness and intellect, according to the extent and degree of the material organization and development.

Not half nor a quarter of the matter in any living organism, the human body, for example, is subjective or personal; a great deal of the organism is not in the consentient condition, and hence is objective to us.

In studying the phenomena and the causes of old age and organic death, we have therefore to keep before our attention two phases or aspects of the organism, twin pictures of life, so to speak, the objective and the subjective picture.

In the objective picture we have the organism, composed of a hundred and fifty pounds of matter, displaying energy in locomotion and a hundred mechanical movements. More intimately we find it to be the seat of a vast, complex chemistry, wherein are re-duplicated on a smaller scale nearly all the chemical activities which are found anywhere in the universe outside it. In order to live as an individual, the organism is obliged to maintain all these complex series of activities, and maintain them largely counter to those of the universe without. To such an extent is this counter action a fact, that the Hindu doctrine of primitive incarnations is not devoid of a deep significance to the modern biologist. From the objective point of view, all individual, personal life is a transient struggle against the universal personality of cosmos, a short, stormy secession from the whole, a brief contention with the greater, all-embracing life of the world. Not inaptly has some one of late compared humanity, in its relation to the universe, to a tribe of disease bacteria in the human body. Individual life on the earth has many of the aspects of parasitic existence.

In the other or subjective picture, the point of view has shifted; the personal life from its own axis or centre, looks forth on the world and is aware of itself and its environment. *It* is now *I*. By virtue of an ancestral development which extends back to the antiquity of life on the earth, this human ego consists of several millions of brain and nerve cells, connected and united together by means of a marvellous net-work of sentient protoplasmic filaments in a unit of consentient living matter which sees, hears, and feels the external world. It is highly sentient and retentive of sensory impressions from without; and immediately, from the embryonic period onward, it begins to garner and assimilate these impressions, which stand for the data of its knowledge of good, of evil, of all things. An intellect is thus a consentient growth, a development, *pari passu*, with the material growth of the unified cell mass.

This development is the *form* given to the intimate substance of the living matter by its sensory contact with the external world; and over this *form* the primary sentience of matter plays and flows, as water about the stones, pebbles, and gravel of a brook bed. It is this *form*, impressed by sensory contact with the external world on the living matter, that gives character and personal bias to the man. The simile of a brook is but a tame one; for the life, thus formed and developed, is rather as a magnet in its field, influenced and influencing, through etheric continuity, the entire world about it, animate as well as inanimate things. It is a living, self-centred mirror, in which is pictured its environment, and which reflects and reacts on that environment.

In the problem of prolonging life we have to consider, first, what the personal life, acting outward from its own axis of being, can accomplish by self-effort, or " will power"; and second, what can be done to facilitate the processes of life by skilful adaptations of external agencies.

Practically, hitherto, we find that one enthusiast will have relied wholly on subjective effort, while another places faith entirely in remedial science.

The present biological view is to closely and connectedly supplement subjective effort by all known adaptations of objective agents.

## ON THE DISPERSION OF THE GERM ELEMENTS.

As bearing on the question of the prolongation of life, — the renewal and maintenance of cell life, — I wish briefly to call attention to an aspect of embryonic growth and development which I do not remember to have seen noticed. I refer to the local, mechanical dispersion of the germ elements, collected and collocated in the ovum or embryo, and their wide and wider separation, locally, as the embryo develops to the fœtus, and the infant grows to adult size.

According to our present conception of the manner in which the germ elements are aggregated in the ovum, we have presented the picture of a large number of protoplasmic molecules (" biophors," "plastidules," "gemmules," "physiological units"), diverse in characteristics and containing the aptitude, bias, or previously endowed capacity for growth into different tissues,—bone, muscle, brain, nerve, epidermis, etc. As yet, however, these diverse germ elements are contained within a radius of one two hundred and fortieth of an inch,—a little spherule of protoplasmic matter scarcely visible to the unassisted eye.

Within this minute dot the reproductive force of the parent organisms has concentrated germinal elements or units so stamped, or given form, that when facility for growth and increase in bulk is afforded, they will first multiply and afterwards, retaining each its endowed bias, produce muscle, bone, nerve, skin, etc., for twenty-five years, till the organic limits are reached, and thenceforward, for fifty or eighty years more, will still display a certain power to maintain and even renew these tissues, when damaged. All this scheme of extended growth and life is resident in this minute, soft, apparently homogeneous dot of protoplasmic matter. We do not say that the *power* is there resident, but the bias, the aptitude, the arrangement, which directs growth and retains character, even for a century.

As a factor of the problem of self-renewal, I now wish to point out the relatively enormous distances to which these germ elements are dispersed, or scattered, in the adult human organism,—scattered and dispersed by growth from their starting-point in the ovum.

It is not necessary here to take up in detail and technically the progressive steps of segmentation or cleavage of the ovum or its yolk into the primary nucleated cells, or the separation of blastoderm into "hypoblast," "mesoblast," and "epiblast," from which the three principal groups of organic tissues develop. To present the view of the subject to which it is my purpose now to invite attention, it is needful only to bear in mind that the first nucleated cells which appear in the segmented ovum go on multiplying by dividing into other new cells, which eventually become the different groups of tissue cells that produce, by alloys of their protoplasmic substance, the bony skeleton, the muscles, the skin, the special organs, the nerves, the brain. We have to conceive of these tissue cells as first, during embryonic life, increasing in numbers a million fold, and becoming dispersed or borne asunder by the products which they form. Later, toward the end of the embryonic period, we find that they have ceased to increase in numbers, but continue, during infancy and adolescence, to produce tissue from the accumulation of which they are borne still farther apart; that later still, during the adult period, they replenish and maintain the tissue already produced, and to some extent renew tissues which are accidentally damaged or destroyed; and that finally, during the period of old age, they fail not only to multiply in numbers and produce new tissue of a normal character, but cease largely to maintain and repair the existent tissues.

There is, during the embryonic and adolescent periods, a progressive moving apart of the tissue cells, a dispersion, till in the adult period, and especially in senescence, we find that the vital units which were once in contact or in close juxtaposition in the ovum are now separated by relatively enormous distances, by spaces and intervals filled by "formed matter," that is to say, non-living matter, or substances which are but very imperfectly sentient.

A fibre-producing cell of one of the skeletal muscles of the foot for example is separated from its whilom fellow-cell, which now produces or maintains fibre in a facial muscle, by an interval of two hundred and sixteen thousand cell diameters. Or assigning the maximum size allotted to the "germ elements," we must picture these latter as having been borne apart to a distance of many billions of diameters.

The extent of this outward dispersion in space of the vital units of a human embryo can perhaps best be illustrated by likening them to a family of children born and bred in the parental mansion, which for convenience we will suppose to be located at the National Capital. At a given date they all leave home and journey forth, to make their fortunes and assume their fated places and positions in the world. Some, indeed, go no further than Baltimore, Philadelphia, or New York; but others go on and on, to Oregon, to California, to Maine, to Canada; and if we attempt to preserve the simile we must picture others as removing to Alaska, Honolulu, South America, Europe, and farthest Asia. Nor, indeed, are these far migrations adequate to illustrate the wide dispersion of the once contiguous "physiological units."

Little wonder would there be if brethren thus remote and sundered for life should in time fall out of kindred sympathy and well-nigh forget each other's existence.

In the schene of organic life, however, each cell unit remains in a quasi-sentient relationship with every other cell unit of the original family group; and it is only when this consentient relationship slackens and begins to cease, when discordination begins to ensue, in the place of the earlier more complete co-ordination, that "old age" comes on and death commences.

Confining ourselves wholly to the mechanical or mathematical aspects of the dispersion, the question normally raised would appear to be, whether these relatively long distances, to which the vital units of the organism are removed one from another, have anything to do with the observed gradual decline of their power or capacity to live and maintain the human personality.

## IS IT DIRT?

Dirt, which has been well defined as "matter in the wrong place," is commonly supposed to be a molar condition of terrestrial matter which does not prevail nor exist in the molecular realm. Hence, by virtue of this molecular exclusion and the elective power of living matter to choose and select such particles as it pleases for its nutrition, the protoplasmic cell has been presumed to be in the "chemically pure" state. There is reason to fear, however, that such an assumption is gratuitous and far from accurate.

Certain manufacturers send us samples of their productions, particularly articles in use for microscopic work, which they claim to be "chemically pure." "Chemically pure," in fact, has long been a favorite trade shibboleth, as contrasted with "commercially pure," which generally means very dirty indeed, but not always.

Only a microscopist knows the full bitterness of the life struggle with dirt. Beneath high objectives "chemically pure" often resolves itself into a jest too grim for laughter.

It is doubtful whether even a gas can be, or at least has been, generated chemically pure, so omnipresent is dirt. Dirt is Nature's heterodoxy. It is the greatest obstacle to evolution, and ushers in death in a thousand forms. The story of life on this earth is the story of a constant struggle with dirt.

"But mother's milk is pure," one of our associate observers used to assert, dogmatically, everything else having been shown to contain dirt. We were at some pains to demonstrate to him that, alas, even mother's milk was not pure; whereupon, he hedged like a sectarian, and retiring behind the unverifiable said, "*My* mother's was."

The animal organism is a great destroyer of dirt; that is to say, the various ferments and "juices," which it is the life work of many groups of the somatic cells to secrete, act chemically on dirt as well as on true food, on innutritious as well as nutritious substances, to break them down to the elemental condition. Having passed the digestive tract, too, and entered the blood plasma, still further reduction, elimination and vitalization take place before the highly rectified particles go to the cells of the nobler tissues and organs.

In an adolescent organism, normal, healthy, and strong, this eliminative process is practically adequate. Adventitious substances are expelled or broken down and resolved chemically.

But in older organisms, during periods of weakened action, the process of resolution is less complete; microscopic dirt may accumulate in enfeebled cells. If not dirt, what is that darker-tinted residuum in old protoplasm? Will not some observer answer that question — answer it with the exact facts thereto pertaining?

Is there dirt in the blood? Or rather, to how great an extent is the blood a dirty liquid? In other words, is dirt taken up, associated with nutritious particles, by the absorbents and lacteals?

An examination of chyle with a view to discern dirt particles, if such exist in it to any large extent, is one of the many lines of microscopic research suggested for future work at this laboratory. But meantime, will not some other investigator attempt it? The actual composition of the blood plasma is a subject about which our ignorance resembles the fog of a winter night; yet this same blood plasma stands very near to human life. It is a heterogeneous fluid, containing various floating particles of "formed matter" from other dead organisms, and ptomaïnes of bacteria, in which swim millions of living disks and amœboid bodies; and it may be as dirty as ditch-water; there is reason to suspect this.

We know that the fine particles of inorganic substances, administered as medicines and poisons, pass readily into the blood and speedily enter the protoplasm of brain and muscle cells. Why not all sorts and varieties of dirt particles, some noxious, irritant, or depressant, others reactionless, but inert and obstructive, and having a tendency to accumulate and occupy room within the cell? In the examination of old amœbæ which are nourished in dirty water, we see a great deal of this. Under high power the same is discernible in a culture of bacteria which can be killed out by an admixture of dirt in the fluid.

It is not of the chemical action of inorganic particles in the protoplasm of the cells that I am here treating, however, but of their merely negative behavior, or presence as dirt. A particle of arsenic, antimony, or iron may excite protoplasmic action which may speedily result in its expulsion, resolution, or encystment, where a merely reactionless particle of sillica or lime might remain in the way, as an obstruction, for days or months. Is the somewhat discolored, more rigid, less elate condition of the fibrils of a brain cell in an aged organism due to infiltered, accumulated dirt? What observer will assist to answer this question? Strange, if old-aging were a result of dirt?

Of course we are here speaking of microscopic dirt, not dirt particles visible to the unassisted eye, but of those which float in air, swim in the dew drop, even in spring water and distilled water. Those minute omnipresent particles of which, as the late Prof. Tyndall used to be so fond of saying, skies are made and look cerulean. Of which haloes and sun-dogs and zodiacal lights are the reflections. Of that well-nigh impalpable triply sublimated dust that streams up into the higher regions of the atmosphere from out the vast hot flues of Krakatoa, Ætna, and Popocatapetl and, floating aloft for months, exhibits to the inhabitants of opposite hemispheres, magnificent, green-tinted sunsets.

We familiarly gain an idea of the dirt in ordinary respirable air by glancing at it as it rises into the sunbeam which falls into a room through a chink in the window shutter. But those motes in the beam which float so buoyantly are Donderbergs compared with the kind of dirt we are here speaking of. Torrents of these relatively huge motes go rushing down the bronchi into the lungs at every inspiration, but are caught in the main on the epithelial surfaces and expelled by the outward lashing cilia. Not these, but almost infinitely smaller particles, constitute microscopic dirt, particles both organic and inorganic, akin to those which rush off from the traditional grain of musk and for a quarter of a century fill a room, to the not sensible dimunition of the weight of the musk-grain; particles like those which exude through the sole of a boot, and are diffused for hours about the footsteps of a man on a clean hard pavement, so copiously that his dog will track him.

Certain of those never to be too greatly commiserated persons, the hay-fever sufferers, have turned microscopists with a commendable design of finding out exactly what it is that ails all their noses. Incidentally, they have somewhat enlarged our conception of the insidious nature of dirt. They find not only the floating spores of their great *bête noir*, rag-weed, and much other titillative pollen, but an immense variety of terrestrial and cosmic dust, blown up off the terraine by winds, and sifting down out of celestial space from the constant bright cremation of meteorites. The burned-out cinders of dead worlds afar, as well as the constant erosion and decay of our own, contribute the dust of their ashes to the untimely extinguishment of poor struggling earthly life. With doleful Schopenhauer we may exclaim, and with greater truth than he ever dreamed of, "The dead, alas, are in us!" For within the aging cells of a human brain may, beyond doubt, be found a modicum of dirt, lodged there to our mortal hurt and undoing, from the most diverse quarters of the Celestial Pole!

"Dirt in victuals" has always been one of the recognized reasons for a change of boarding-places; and the services of a microscopist have not always been needed to set up a case. When it comes to microscopic dirt, however, food in the best regulated households is a disheartening admixture. The neatest of cooks may labor in vain to bring forth a pudding that is not dirty. In fact, wheat flour, as we now get it, is not only dirty but actually filthy; and there is no doubt whatever, that measures such as might be taken at the great flour mills, for cleaning the wheat previous to milling, at a slightly increased cost, would redound to the general health of the population. For not only is fine sand and loam at present ground with the wheat, but pellets of clay and of gravel, often as large as the kernels themselves. Wheat flour has come under our observation which contained as much as four per cent of dirt-grit. Such grit is, of course, far more deleterious than the sillicates of the wheat hull, or the lime salts contained in bones, which indeed are required by several large classes of cells in the human organism for the production of teeth, nails, hair, bone, skin. From having been already broken down and brought into solution by the cells of plant and animal organisms through which they have previously passed, such salts are far more easily reduced to assimilable condition in the human organism than are minute grains of sand, taken directly from the rocks.

The question here raised, as regards dirt, is whether minute particles of inorganic matter, or obdurate organic matter, entering the plasma of the blood, find ultimate lodgment in the protoplasm of the cells, and remaining there undissolved, chemically unassimilated, or unexpelled, give rise to those aspects which distinguish aged from young cells. Are accumulations of microscopic dirt in protoplasm one characteristic of old age?

If solved, *pro* or *con*, the question will probably be best approached by the detailed examination of old cells under a very high amplification. The writer at present does no more than broach the question. If not dirt, what is it that gives to an old cell its characteristic appearances?

# THE CAPILLARIES IN YOUTH AND AGE.

THE capillaries of the blood circulatory, or vascular system, are a growth from distinctly differentiated protoplasm, which passes through a well-marked cycle of development and decline, in the midst of and associated with other tissues of the animal organism. Nutrition, oxygenation, and the removal of waste are contingent upon their well-being.

As the organism ages and encounters the wear and tear of life, the capillaries, even more than other tissues, suffer detriment. The nuclei of their coats shrink and perish, and the minute tubules themselves become blocked up, obliterated and absorbed. Where the nuclei have perished, no renewal or renovation can take place. So far does this deterioration and obliteration sometimes extend, that it becomes an interesting question, how far the decline of other tissues is accelerated by it.

To gain light on this point and ascertain the condition of the capillaries in age as compared with adolescence, prizes were offered from this laboratory, for research in this direction, as a part of the general investigation of the causes of old-aging and organic death.

The offer was first made as long ago as 1890. The sum of money involved was nominal, and the experiment was made less in the expectation of results from the money *per se* than in the hope that the offer would serve as a species of *point d'appui* for really needed work in minute anatomy. The circular issued to microscopists was as follows: —

> " In the hope of adding to our present knowledge of the causes of failing nutrition in aging organisms, the undersigned hereby offers three cash prizes of $175, $125, and $100 for the best three comparative demonstrations, by means of microscopical slides, of the blood capillaries in young and in aged tissues, canine or human.
>
> " By young tissues (canine) are meant tissues from animals between the ages of one and three years.

> "By aged tissues (canine) are meant tissues from animals not less than twelve years of age.
>
> "By young tissues (human) are meant tissues from subjects between the ages of ten and twenty years.
>
> "By aged tissues (human) are meant tissues from subjects not less than sixty-five years of age.
>
> "While a preference will be given to demonstrations from human tissues, it will be possible for work in canine tissues to take the first and, indeed, all of the prizes. But of two slides equally well done in all respects, one canine the other human, the latter will be given the preference. Canine tissues should be from large animals.
>
> "Twelve slides from young and twelve from aged tissues must be submitted by each competitor, together with a full description of the subjects, methods pursued, and every detail and circumstance which is likely to throw light upon, or account for, any peculiarity. The slides are for comparison as to the condition of capillary circulation, the young with the old, and should be in numbered pairs or groups from the same kind of tissue. The term 'tissue' is used in a general sense, *e. g.*, pulmonary tissue, hepatic tissue, renal tissue, osseous tissue, muscular tissue, nerve tissue, alimentary tissue, etc.
>
> "No particular schedule of methods for injection, staining, or mounting will be insisted upon, and no more definite directions or explanations will be given.
>
> "The slides, carefully packed and boxed, together with descriptive manuscript, can be sent by mail.
>
> "This offer is made on the first day of January, 1890, and will remain open until the twentieth day of August, 1890.
>
> "Slides and manuscript will be examined and receipted for as soon as received.
>
> "The prizes will be adjudged on the first day of October, 1890." — *The Laboratory, Norway Lake, Maine.*

Indirectly, the offer resulted in the receipt of a considerable number of specimens illustrating capillary circulation. Quite a good many facts and items bearing on the subject were also elicited, incidentally, and the laboratory was able to purchase a quantity of slides of some value to the investigation. But as showing the limitations of histology in America, it is a fact that not a single set of twelve slides was submitted for examination. It is likely that the sum offered was too insignificant to attract expert work for money's sake; and that the object in view failed to enlist the interest of amateurs. The result will at least serve as a hint to any one who may have meditated making a similar offer.

As remarked, however, a number of facts and items bearing on the subject of capillary circulation in old age came out of it.

Histologists generally agree that capillary tissue is of the nature of a growth or prolongation of the epithelium lining the arterioles and veinlets, into the substance of the other tissues of the body.

As to the manner in which the capillaries thus grow and ramify there, there has been difference in opinion. Most concur, however, in the view that the capillary protoplasm, like the fresh shoot of a tree, pushes out by bud-like extremities into the adjacent tissues; and that the shoots become hollowed out, forming minute tubules as they proceed; although certain microscopists have held that the proliferating bud first assumes the form of a leaf which subsequently curls together to form the little tube. This bud or protoplasmic shoot pushes its way amidst the growing tissues of all adolescent organs. At first, and for a little distance, it is apparently pure protoplasm; but immediately vacuoles begin to form at the centre of the stem and these rapidly coalescing form a lengthened tube along which the blood advances.

A growing capillary shoot, upon encountering another bud, or a shoot, of the same variety of protoplasm, joins it, and the one tubule opening into the other a capillary loop results.

It may be further stated that the diameter of the capillary tubules is from one fifteen-hundredth to one three-thousandth of an inch; that the loops which they form are of both circular and elongated shape; that in the more active tissues of the body, *e. g.*, the lungs, liver, choroid coat, and brain, the loops are so densely interlaced and confluent that scarcely a space one fifteen-hundredth of an inch in width can be found not crossed by a capillary tubule; and that after devious ramifications and anastomoses, they all gradually converge into larger and larger tubules, or veinlets, which at last unite to form the large venous trunks by which the blood is returned to the heart and lungs.

It is in the capillaries that the nutritive particles from food which have entered the blood plasma are transferred by endosmose and, as some believe, by the selective action of the nuclei in the walls of the capillary tubes, to the protoplasm of muscle, gland, nerve, or other tissues. Through the capillary wall, too, the oxygen from the red blood corpuscles makes its way to the cells.

A young, freshly grown capillary shoot displays a bud cell at its outward extremity; but immediately that the tubule has formed and its walls have thinned out and assumed the semblance of a membrane, the actually living protoplasm is restricted to a few small cells or nuclei, scattered along its course. The membrane, which is no longer in any true sense protoplasmic, performs the function of a sieve or strainer, merely, through which fluid constituents and gases from the blood pass and repass. It is not yet fully known to how great an extent the nuclei in the membranous wall act on the blood, or what elective action they exert over the ingress and egress of nutritive and waste particles. Their presence in the membrane appears to be of the nature of a survival from the growth period, when the tubule was projected, and their office in old capillaries to be *emeritus;* yet, are they capable of being revived and called into active function for the repair of the membrane when ruptured, or otherwise damaged, by the wear and tear of the blood current and the erosive action of oxygen?

Under high amplification, the membrane or capillary wall presents the appearance of a network of lines, which mark the borders of the cells of which it was originally formed. In old subjects, these have mainly passed into the condition of non-living matter. In many cases, too, the nuclei appear to have shrunken and perished; so that from the primarily living and growing condition, the older capillaries have fallen to the estate of a lifeless tubule, the wall interspersed here and there over its surface with small specks or spots of still living protoplasm, for the most part dormant, but capable, if occasion arises, of revivification and a further production of the membranous substance; even as a shrunken osseous cell, or nucleus of the same, may, upon breakage of a bone, be recalled into all its primary activity. The same is true of every dormant cell, or cell nucleus, of the organism; any and every tissue may be repaired so long as the constituent nuclei remain actually alive, and have not perished (as is often the case) from lack of nutrition and want of *motif* to live.

This paper, it should be remarked, deals only with capillary circulation, and hence no allusion is here made to the frequently abnormal condition of the arteries and veins observed in aged subjects, due to previous local inflammations of the coats and walls of these vessels, followed by infiltrations and calcareous deposits. None of the specimens thus far examined have illustrated cases of extravasation or exudation of the blood into the tissues, through decomposition of the capillaries, as in cases of virulent poisoning.

The material prepared at this laboratory and elsewhere has been from dogs, cats, sheep, swine, and squirrels; also human, of various ages.

The worst source of error attending a comparative examination of the contributed slides came from the unequal pressure made use of in the injection process. On many of the slides, this point could only be learned approximately. For example, a number of slides from the tongue of a human subject fifteen years of age do not differ perceptibly, as to caliber of the capillaries, from others which come from a subject sixty-eight years old, where, as nearly as can be learned, nearly double the pressure was exerted on the piston of the syringe.

In fact, the injection errata would make it impossible to draw any safe conclusion unless a large number of slides, or sets of slides, were examined. It is only after extended observation of a great many such preparations that a general picture of the capillary condition in youth and age begins to be presented.

Thus far, contrary to preconceived opinions, the facts appear to be that in many aged tissues the capillaries are as densely interpenetrating, with loops even smaller in some cases than in adolescent tissues. On the whole, it is manifest that the capillaries in the same tissues and in identical situations are of larger caliber in youth than in age. The loops are also more nearly circular in form in adolescent tissue, and the whole capillary system of a given organ is more uniform and regular. This, indeed, is what would easily be predicted in advance.

The nuclei of the capillary walls are smaller in aged tissues and often not visible, having apparently perished. In aged tissues the injection fluid more frequently fails to penetrate or traverse the entire loop, so that such capillaries present a more irregular or broken appearance.

The aspect presented by our preparations confirms the often-stated surmise of physiologists and anatomists, that not only the larger vascular trunks but the capillaries are more rigid and less elastic in age than in youth. It is apparent, too, that the tubule has shrunken appreciably in contour and caliber, and it may be from this reason that embolism frequently occurs in old capillaries. It may even be that the caliber of aging capillary vessels tends to contract below the normal size necessary to admit of the passage of the blood corpuscles. Blockade may occur from this cause simply; it often occurs; the aspect of old capillary loops constantly suggests thrombosis.

A capillary channel thus blocked up and fallen into disuse is probably absorbed in time, but not at once; it remains as so much non-living matter for a considerable time. If there be, near the point of thrombosis, capillary nuclei alive and not too toughly encysted, and stimulus from the nerve fibrils is transmitted to them, these nuclei will bestir themselves, expand, and become an active, growing capillary cell, and pushing forward as a bud toward the isolated tissue cells, will hollow a new capillary vessel for that quarter. In aged tissues there are to be seen, amidst the old capillaries, fresher, larger loops which are manifestly of more recent growth. All old capillary tracts exhibit evidences of having been thus renewed or repaired in spots.

As to the frequency of such renewals of loops, or indeed how frequently in the lifetime of the human organism its capillary system is renovated or replaced by new growths and absorption of old choked-up vessels, sufficient data has not yet been accumulated for forming an opinion.

In preparations from aged tissues, as contrasted with control slides from young tissue, there are occasionally seen spots or small tracts where there appear to be no capillaries, as if a considerable area had recently been affected by thrombosis, or else weak heart, and the associated tissue cells in the immediate vicinity had either perished in consequence or shrunk to the proportions of attenuated nuclei. These appearances may, in some instances, be occasioned by the errata of the injection process, but not all of them.

The impression is strengthened by our examination that capillary vessels are formed by the advance of a capillary cell as a bud, pushed into the continent tissues, and the hollowing out of a tube in its rear along which the blood follows from capillaries behind it, as against the theory that a capillary is formed by the curling up into a tube of a leaf-like projection of capillary protoplasm. It may be remarked that these latter appearances are sometimes produced upon capillaries by the action of the microtome.

The capillary cells are beyond doubt a distinct group, or species, having specialized characteristics, and having their own specific mode of nutrition and life. While their interests are bound up with those of other tissue cell groups, they yet preserve a kind of autonomy. That they act upon the blood plasma otherwise than to select what they individually require as food from it, or are, as Prof. Wesley Mills would give us to understand, of the nature of minute glands, may or may not be the fact. There is little in the way of evidence as yet, bearing on these questions. It may even be, however, — such is the blending of cell interests in the organism, — that the sanguineous plasma is made better from what the capillary cells select from it as their food, for the other tissues, — muscle, bone, and nerve.

On the whole, the general picture presented by the capillaries in old age, contrasted with youth, indicates that damage has been suffered from a great number of causes, all the way from the adolescent period onward. Erosion has acted to some slight extent, thrombosis and embolism to large extent, while bodily accidents of all kinds to the organism from without and within constantly harm the minute tubules; yet they appear to be quite as constantly renewed by fresh efforts on the part of the nuclei in the walls. These nuclei in adult normal capillaries are generally found recurring upon opposite sides of the tubules, somewhat irregularly, but commonly not more than one six-hundredth of an inch apart. The nuclei are left in these positions, as the capillary bud-cell pushes out into growing tissue, by its division at intervals into two cells, one of which remains *in situ*, while the other pushes forward as the terminal bud.

At first the cell left behind in the wall of the vessel is of normal size, but from lack of opportunity, or stimulus to further growth, it gradually shrinks to a nucleus, and this in time may perish in old vessels, leaving the tubule wholly of "formed" or non-living matter, incapable of self-renewal if blocked up or worn to holes by erosion.

It seems probable that capillary nuclei often die from lack of vital stimulus, — nuclei which would have been capable of frequent renewals of the vessel, if the necessity had been put upon them. How many such renewals each capillary nucleus has vital capacity for, our researches thus far do not enable us to speak positively; very many, no doubt.

There is little doubt, too, that in very aged and infirm persons decalibration of the capillaries takes place to such extent as greatly to impede the passage of both leucocytes and the red corpuscles. This condition, as well as enfeebled heart-beat, is a cause of bad circulation in old people.

# ON THE CONSENTIENCE OF BRAIN CELLS.*

It is the purpose of this paper to call the attention of investigators to a feature or part of the nervous system and brain which has received hitherto but casual notice and incidental mention, but the profound significance of which, both in the physiological and psychic sense, I shall attempt to point out. I refer to the densely interlaced and involved processes or long, slender protoplasmic branches of the cells of the nerve centres, pre-eminently the brain.

The presence of such cell processes and filaments has long been well known; and within the past decade at least two investigators have demonstrated the amazing net-work which they form in the cortex of the cerebrum, by virtue of which thousands of cells exist in close protoplasmic contact one with another.

By the term *contact*, as here used, it is not meant to intimate that the branched processes and fibrils of any one nerve cell coalesce, or become continuous, with those of other cells. The facts as observed, here and elsewhere, do not sustain such a deduction, but go to show that the sensitive fibrils of the cortical cells very closely approach and, during the elate, erectile condition of diurnal wakefulness, actually *touch* each other. In sleep, the contact is broken, — a condition of non-contiguity, brought about, as has been conjectured here, wholly or in part by the collapse of the blood capillary system in the cortex during somnolence.

Until very recently, no observer appears to have fully comprehended the profound psychic significance of this extraordinary web of living threads.

"It may be asserted that the brain of man owes the superiority of its activity, largely, not only to the surpassing numbers of its elements

---

* This subject was, in substance, set forth from this laboratory in the winter of 1892. Dr. Ramon y Cajal's memoir from Barcelona was published fifteen months later in *La Cellule*, Brussels. Questions of priority in research are invidious at best; nevertheless, it is a source of satisfaction with us to know that our work was not only fully abreast but fairly in advance of that of the European *savant* whose discoveries and theories are now attracting so much attention. — *Ed.*

[cells] but to the remarkable richness of its ***means of association,*** meaning by this, the lateral branches of the axis cylinders and protoplasmic branches from the cells themselves." — *Dr. Ramon y Cajal in La Cellule,* 1893.

Gehuchten, Obersteiner, and His have also observed and called attention to the extraordinary length of the protoplasmic branches of brain cells, and to the extended and intricate net-works which they form in the cortex. Dr. Baker, of the United States National Museum, has published a concise review of these investigations.

It will be seen, therefore, that the protoplasmic branches which issue from the cells of the brain and spinal cord have already begun to attract the attention of histologists in a special sense and have piqued not curiosity alone, but conjecture as to their office and function.

An attempt will here be made to show that these marvellous networks of sentient, protoplasmic threads are not only a means of association of cell with cell, but that they constitute the consentient web of living matter by means of which self-consciousness and personal identity exist and are possible, from moment to moment and from year to year. In a word, that it is by means of this vast network of interactive fibres, fibrils, and filaments that the many millions of cells of the brain are able to live as one self-conscious entity and give rise to a personal intellect.

But first it appears necessary to say a word of the cell itself and of certain recent views concerning it as the structural, vital unit of multicellular organisms.

The progress made in biological science during the last ten years, while it does not directly controvert the cell doctrine, as formulated from 1840 to 1870, may yet be said to limit it and modify it profoundly.

In fact, it is not too much to say at the outset that we are now compelled to regard the protoplasmic cell somewhat in the light of a survival from unicellular life.

All life, it is true, is exhibited either from a single cell or from an organism composed of many cells; the tissues of all the higher organisms are made up of cells and their products; yet we have learned that the embryos of these organisms develop in accordance with higher, more esoteric laws than the mere growth and multiplication of cells; and also that there is within every such higher organism a deeper seated, more prevalent directive power, which bends cell life to its behests. In brief, the cell is no longer regarded as the autocratic vital unit of evolution. Strasburger and De Vries, as also Whitman and Wilson, have given us glimpses of the workings of this more esoteric directive power, which makes the cells its playthings, or rather the signs and symbols of its action.

Weissmann's labored system and theory of the germ-plasm has at least given us some conception of those invisible elemental bodies which are grouped in the embryonic cell, and which are the directors of its growth and development. Weissmann's "biophors," "determinants," and "ids," may be, probably are, largely ideal and arbitrary; yet there are a thousand coincident indications which go to prove that some such germinal bodies actually exist.

The real biophor, or some like body, may be the protoplasmic molecule; our microscopes do not aid us here; but it can scarcely be doubted that from the "atoms" of universal matter, a series of little organized bodies have brought life upward from the lowliest elements of life, till in the cell we see it exhibit true psychic powers,—self-consciousness, hope, fear, and the perception of what is good and what is bad.

We hold, as a working theory, that matter universally possesses the elements of consciousness; but from those primary elements upward to the self-consciousness displayed by the cell the way is long. Step by step, by the slow process of organization, life has mounted to higher and higher intelligence. We no longer regard the cell as the first step, however, but the next to the last of the series; no longer as the primeval unit of life, but as a long-derived, complex organism, in which thousands of more primary forms of life find expression.

It is convenient in research, however, to retain the use of the term "cell." It is true, moreover, that in the cell, as we find it in unicellular life and in the tissues of the human organism, pre-eminently the brain, we have what is practically a living creature, which takes nutriment, grows, feels, and lives.

In the human brain we find that the cells are made the well-nigh passive instruments of a consentience or totality of brain life, which modifies, develops, and dominates them,—a *consensus* of the entire brain, grown to that greater knowledge which has come in through all the avenues of the highly developed senses.

The aspect, shape, size, and contour of the brain and its appendages, the spinal cord and nerve trunks leading to the various tissues and organs of the body, are familiar matters.

Histologically, as the abode of the genus of intellectual cells, it must be conceived of as a vast skein or congeries of nerve fibers, on the outer surface of which, carefully roofed over by the cranium and tough membranes, lie the most important groups of cells.

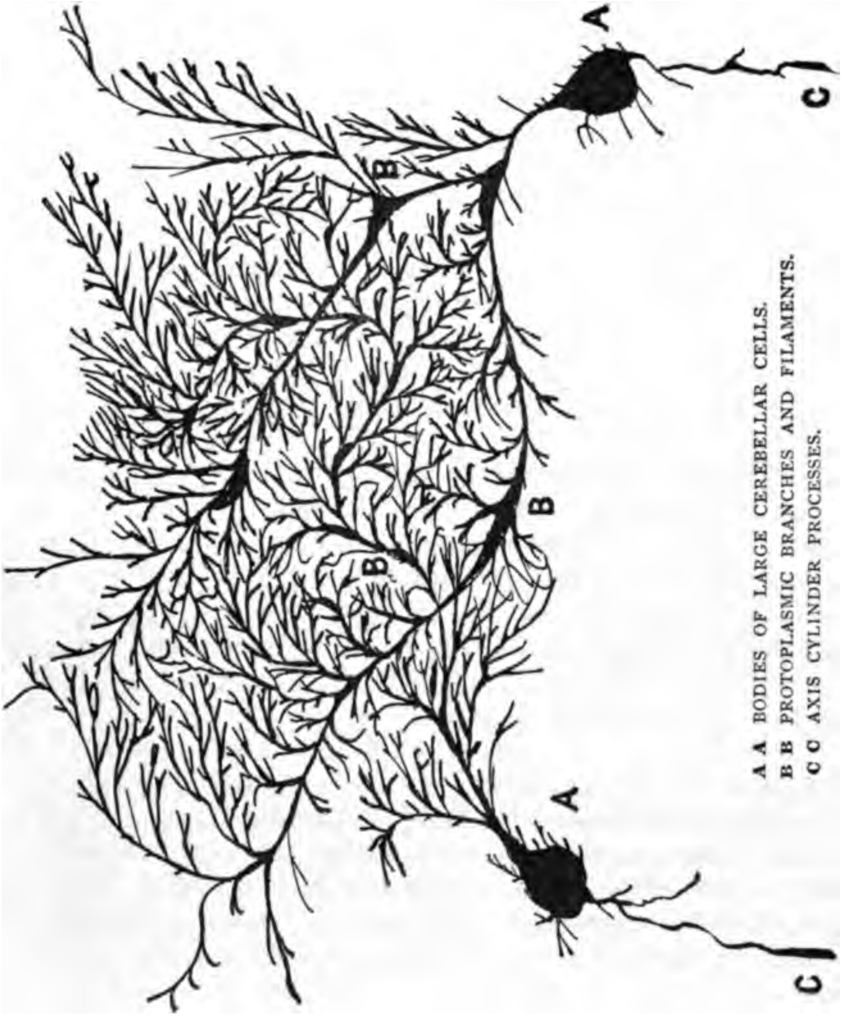
It is of these cell groups of the convoluted, outer surface or cortex of the brain that we shall here speak almost exclusively, scarcely more than referring to the great nether group or groups, commonly described as the nuclear and fusiform cells; for it is in the cortex that the ramifications of the cell processes which we are to study, are best exemplified.

These cell groups of the cortex, of the cerebrum, and of the superficial gray matter of the cerebellum, are wonderfully well situated for nutrition, supported at ease, so to speak, by the fibrils of servant cells of inferior grade (neuroglia), lodged in fluid beds, and guarded by protective or repair cells. Great advantages are theirs, and great things in the line of intelligence are accomplished by them. Not even our best methods of preparation and staining have yet enabled us to trace all the delicate branches, fibrils, and processes which they thrust forth and maintain permanently extended, in order to touch and to lie in sentient contact with those of other cells, thus enabling hundreds of them to live in close perception and sentient communion one with another.

The cells of this class, or species, from the human cerebellum, or lesser brain, differ considerably in size and general appearance, from those of the cerebrum, and also from those of the spinal cord; but from their position and connections, their psychic role is believed to be similar, since they are held to preside over and inaugurate the passage of subjective sentience into molecular motion.

Sketched roughly with a pen (for I have not succeeded well with micro-photographs of slides), the protoplasmic processes of the large Purkinjé cells from the folia of the human cerebellum interlace much as seen in the accompanying reproduction. But neither in this drawing, nor in that of pyramidal cells from the cortex cerebri, which follows, are the amazing net-works which the branches and filaments form, fully depicted, as revealed by corrosive sublimate staining. As seen on the slides from which the sketches are made, the networks are finer, closer, and far more delicate.

These Purkinjé cells, so called, are from .03 to .04 of a millimeter in length; but the branched processes and fibres which emanate from them are of far greater extent.



A A BODIES OF LARGE CEREBELLAR CELLS.
B B PROTOPLASMIC BRANCHES AND FILAMENTS.
C C AXIS CYLINDER PROCESSES.

These cells are collocated in a layer at a depth of less than a millimeter in the outer stratum of the foliated cerebellar surface, and are nourished from a rich capillary plexus. They are supported, that is to say, held up otherwise than by their own consistency and firmness, by a system of adjuvant cells known as "spider cells," or "basket cells," which some observers have been inclined to classify as nerve cells, but which most now rank as a variety of connective tissue cells, denominated "neuroglia." In some tracts of the brain these spider or basket cells have been discerned as forming a net of supporting fibres about the body of the larger nerve cell.

From what may be designated as the base of the nerve cell, there emerges a process or protoplasmic branch, termed the "axis-cylinder process," which dips downward into a layer of smaller nuclear cells and enters the great skein of nerve fibres which forms the central parts of the brain. How far this axis-cylinder process or fibre proceeds has never yet been fully demonstrated, but it is believed to proceed to or become continuous with a fibre which does proceed to other tracts of the opposite hemisphere of the brain, and even to pass down the spinal cord and extend to distant tissues of the body.

Reverting again to the body of the cell, we find issuing from the other side, the side opposite the base and hence the part directed toward the outer surface, one and frequently two large branching processes, which often extend a relatively great distance toward the extreme outer surface of the cortex and branch, like a tree-top, into smaller and smaller processes and fibrils, till the best methods of preparation fail to trace them farther.

In this outer layer of the cortex of the cerebellum (which has been inappropriately termed the *molecular* layer), the extended, constantly branching processes of many cells lie side by side, contiguous, and in contact; and as these processes and fibrils are protoplasmic and sentient, we can scarcely doubt that they *perceive* each other from such contact, and communicate one with another. In a word, there is the strongest probability, short of certainty, that the business of *willing* movement outward to the muscles is dependent upon the concerted action of these cells.

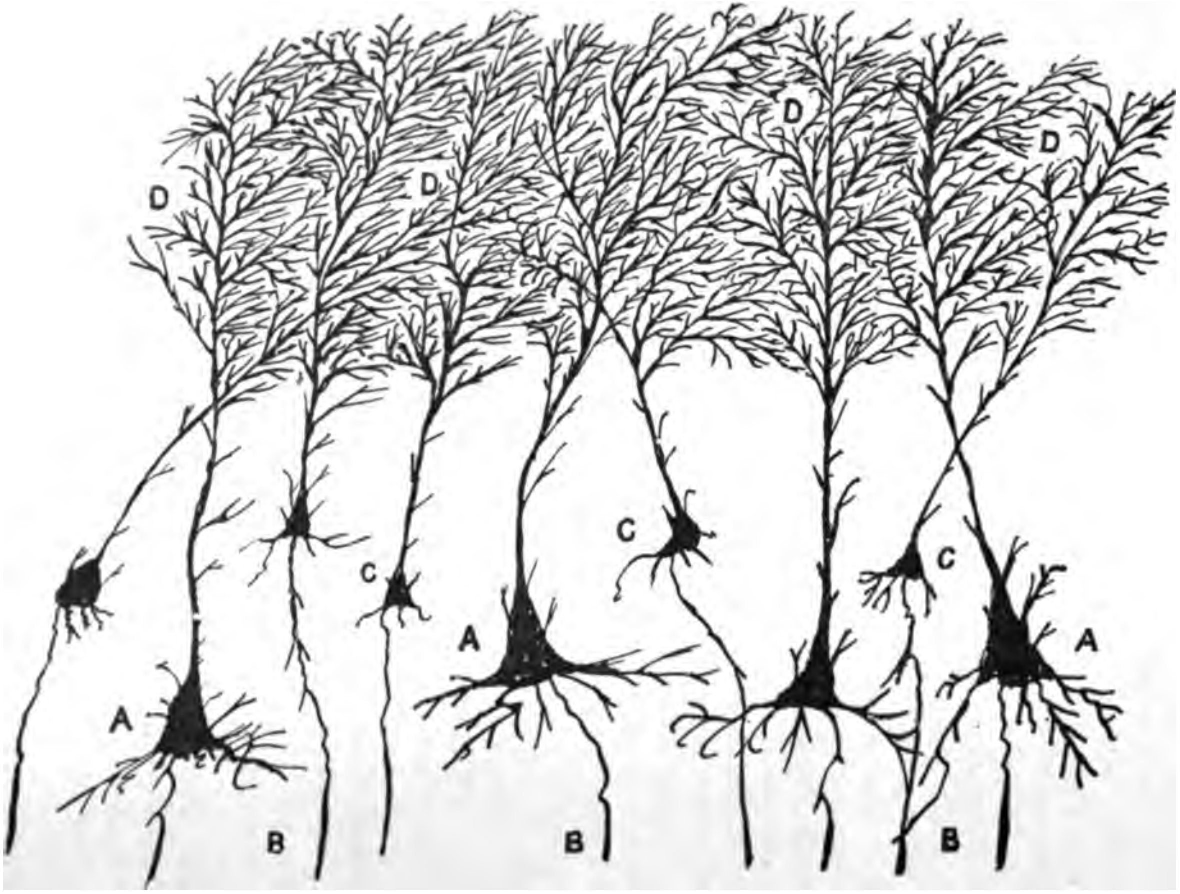
Besides the fibrils of the large Purkinjé cells there are also in this outer "molecular" layer minute fibrillar processes from great numbers of smaller cells which lie embedded in it; also nervous fibrils which, so far as discovered, are not processes of cells, but seem to be of the nature of separate growths, analagous in some degree to the fibres of muscular tissue, which are not pure protoplasm but of the nature of protoplasmic alloys.

These latter minute fibres also lie in contact with the diffused fibrils of the Purkinjé cells, and apparently bear sentient impulses from them downward into the vast hank of central fibres.

Beneath this layer of large-branched cells, there is another class or variety of smaller nuclear cells, the bodies of which have scarcely one fourth the diameter of their superior neighbors. Many of these have small fibrillar processes, one of which is sometimes seen to rise toward the "molecular" layer, while the other dips downward amidst the white *fasces* of fibres. The function of these smaller nuclear cells is not as easily divined; it is not certainly known that they are not the nuclear prototypes of the Purkinjé cells, capable, if need arose, of developing to such cells.

In the medulla oblongata and in the gray columns of the spinal cord are also found large cells with branched protoplasmic processes, somewhat resembling those of the cerebellum, with small nuclear cells and fusiform or spindle-shaped cells, in connection with the same mazy hanks and bundles of communicating fibres. And in the great hemispheres of the cerebrum, or grander brain, is found an arrangement of superior cells and inferior cells, with enormous hanks of fibres similar to that observed in the cerebellum, but on a vaster scale.

The superior and larger cells of the cerebral cortex differ in form from the Purkinjé cells, and from their triangular outline have received the name of pyramidal cells. They are found in great numbers and at varying depths in the "molecular" gray cortex of the cerebrum. The body of a large pyramidal cell averages about 40 $\mu$ in length by 20 $\mu$ in width (or not far from $\frac{1}{650}$ of an inch by $\frac{1}{3010}$ ). It occupies a free space, is surrounded by blood capillaries which supply it with nutriment, and rests easily in lymph fluid, with a number of protective cells and repair cells in close attendance upon it. It is further supported by the nets of "basket" cells (neuroglia), and altogether is placed in a position of ease, as if for intellectual labor. The large cell body contains protoplasm which, however, as prepared for examination under the microscope, often assumes a granular appearance; and within it are to be seen the essential cell nucleus, occasional vacuoles, and very frequently a few grains of pigment. The base of a pyramidal cell is directed toward the axis of the brain convolution, *i. e.*, toward the mass of white medulated nerve fibres of the interior. At the base, the protoplasmic cell-substance is



A A A LARGE PYRAMIDAL CELLS OF THE CORTEX CEREBRI.
C C C SMALL PYRAMIDAL CELLS.
B B B AXIS CYLINDER PROCESSES.
D D D APICAL PROCESSES AND PROTOPLASMIC BRANCHINGS.

prolonged downward in a number of branched filamentous processes; and ordinarily, about midway, one of these assumes the character of an axis-cylinder process, which, entering the mass of sheathed fibres, becomes one of them, extending eventually to some distant quarter of the brain or of the body. The other processes from the base, especially those from the outer corners, branch out in finer fibrils, which intermingle with those of other cells and with the minute fibres which certain cells appear to produce and cast forth from their cell bodies.

A still more remarkable process, however, rises from the apex or top of the cell. This apical process is directed upward or outward into the cortex, branching at intervals and extending to a comparatively great height into the "molecular" or outer layer of the cortex, where its fibrils lie in contact with those of numerous other cells.

In certain situations, noticeably at the summit of the convolutions, some of the pyramidal cells attain great size, comparatively, and are found to have bodies 120 μ in length by 50 μ in width; but, in far greater numbers, there is associated with them a class of small pyramidal cells, much like those described above as regards form and processes, but smaller, having bodies no more than 12 μ in length by 8 μ in width. It is not impossible that these small pyramidal cells are a reserve in slow process of development to the larger class, or would so develop under stimulus.

Beneath the layer of pyramidal cells there is also found in the cerebral cortex a "nuclear" layer of small rounded cells, some of which have protoplasmic processes as seen in the cerebellum; and there is also a fusiform group.

We find that the entire surface of the cortex cerebri is composed mainly of these marvellous net-works, associated with the plexuses of blood capillaries and the adjuvant neuroglia required for their physical support and maintenance. The superficies of the cortex, indeed, is by far the most remarkable structure which minute anatomy has knowledge of. The extent and intricacy of the fibrillar threads, loops, and twigs, formed by the mutual interlacing and interlooping of the thousands of tree-like branches which the cells send upward into it, are quite incomparable. In this respect the cortex of the brain is a hundred times more dense and more involved than are the tops of the trees in a dense forest. The branches, in their amazing ramifications, not unfrequently extend to a distance of twenty times the length of the cell body. It is as if each tree of a thick forest sent forth vines for branches, which climbed to a distance of several hundred yards, dividing as they proceeded into a thousand vinelets and tendrils, which enwrapped and entwined everything in their course. Such a jungle, growing to a height of several hundred feet, would no more than illustrate this astonishing lace-work of the protoplasmic fibrils of the cortical cells.

The histologist is led to inquire with wonder what is the meaning, significance, and use of this mazy output of living filaments.

It cannot be wholly, or largely, for the purpose of accomplishing cell nutrition, for these cells are nourished by the saprophytic or absorptive method, and not by the prehension of food particles.

It is not to accomplish locomotion, for these cells rest nearly stationary in fluid beds, sustained by the nets of neuroglia.

The conclusion is reached, of necessity, that these far-branching processes are thrust forth for the purpose of mutual perception and communication, cell with cell. The sentient, protoplasmic fibrils touch, or so nearly touch that what one cell feels and knows is known and felt by its neighbor cell. It would follow that an impulse or a sensation which comes to one through its afferent fibre from the outer world is felt and known by all its mates throughout that entire convolution or tract of cells, and not only in that one convolution, but — so complete is the protoplasmic connection — throughout the whole brain, which is thus made to take cognizance of sensation as a unit, as a personal, self-conscious individual.

For all this mazy web is demonstrated by the reactive agents of our staining fluids to be pure protoplasm; sentient, living matter, capable of feeling, and able to convey sensation. When, therefore, a sensation, received either through the eye, the ear, the organs of taste and smell, or through the thousand sensory nerves extending to the surfaces of the body, is transmitted along a sheathed nerve fibre and reaches one or more of these large cells of the cortex, intelligence of such a sensation is at once distributed by means of the sentient net-work to a hundred neighbor cells, and from them is diffused over the entire brain, which thus receives tidings as if it were a single huge cell, instead of an aggregation of sixty millions of cells, each a distinct living creature.

By means of this sentient bond of cell to cell, afforded by the protoplasmic net-works, many millions of cell lives are blended in one common life, having one common sense. By means of this bond, too, a higher life than that of the single cell is rendered possible. For by it thought, which is the business of comparing what one cell knows with what another cell knows, begins, and both cells are thereby made wiser in experience. Reason is set up; imagination is made possible; and, in the end, the human intellect is developed from what was at first the primary sentience of individual cells.

For it is not here intended to advance the doctrine that the human intellect is of no higher intrinsic quality than the intelligence, or sentience, of the component brain cells, which are thus united to produce it. By means of this extended organization of cells, something more than a quantitative and cumulative result is attained. Human intelligence differs, not only in quantity but in degree, from cell intelligence. By specialization and organization, a higher plane of intelligence is reached; even, as we conclude, the intelligence attained by the cell is of a higher order, intrinsically, than that of the intra-nuclear bodies, which are believed to form the basis of cellular organization; or even as the sentience of these intra-nuclear bodies surpasses the grade of that which is evinced by the protoplasmic molecule, which, in turn, exceeds that of the simpler molecule of inorganic matter. Biological synthesis would lead us to infer that by means of organization, higher and higher planes of sentience and intelligence have been successively attained — a long series of such ascending steps — since first the simple elements of life began to seek expression in terrestrial matter. Extended organization and the specialization of parts to distinct uses have led to those more complicated actions and reactions in the plastic, protoplasmic substance, the entirety of which issue in a higher kind of intelligence; higher because vastly more of form and of experience is included in the brain as a whole than in the cell.

Briefly, we wish to convey the idea that, according to the present biological conception, the human intellect is something more than the combined sentience of the sixty millions, or more, of cells contained in the brain; that it is an extended development of that sentience to a higher grade of intelligence, a development rendered possible by the association and interaction of the cells, their intercommunication and the mental organization which has resulted.

This association and this organization have, we believe, been largely due to the wealth of protoplasmic branches and fibrils which the brain cells have thrown out in order to come into touch and sentient contact with their fellows.

It must ever be borne in mind that the knowledge which we at present have of the brain cells and their protoplasmic processes is obtained by inspection after death, and after preparation by the use, in this case, of corrosive sublimate staining. We do not certainly know that these processes and fibrils are not more deviously extended in life. So far as observed, however, the true nerve cell always presents the same appearance as regards the extension of its branches and filaments; and it is the opinion of Cajal, Retzius, Kölliker, and others that these branches and fibrils are never retracted or withdrawn, but remain in life, as in death, permanently extended and interlaced cell with cell.

On the other hand, Dr. Cajal sees reason to think that the fibrils of the neuroglia cells which support the nerve cells are alternately, or intermittently, extended and retracted, exhibiting a kind of .amœboid movement; and it is his belief that it is the action of these latter cells and their processes which bring the branches and fibres of the true nerve cells into sentient contact, thus making or breaking the consentience of the brain as takes place in sleep and waking. In brief, that the neuroglia cells and their processes, by virtue of their amœboid contractility, bring the fibrils of the nerve cells into sentient contact, or retract them from such contact, at will, as illustrated in the case of unconsciousness from a sudden blow on the head, or in sleep.

While this may be true, wholly or in part, it is the opinion at this laboratory that the capillaries of the blood circulatory, which form a dense net-work in the cortex of the brain, may be a factor in bringing about sentient contact of the branches and fibrils of the nerve cells. In sleep the capillary net-work is but slightly surcharged with blood, and flaccid as compared with the waking condition.

It is not demonstrated as yet what the mechanism of sentient contact is — the contact of the ends or sides of the branched processes of different brain cells — whether it consists of "end plates" which touch, or something analagous to "cups," or "suckers," which adhere. Once touching, by whatever agency contact is brought about, something of the nature of "current" from cell to cell throughout the whole brain appears to be set up and maintained at a considerable tension during self-consciousness, *i. e.*, during wakefulness. To generate current for maintaining the consentience of the brain as a whole, an increased blood supply is requisite; work is actually done and energy absorbed. The condition, moreover, gives rise to waste products and leads to exhaustion of the cell, after from ten to fifteen hours, rendering a period of recuperation and rest necessary. The consentient curcuit must needs be broken. In sleep, the brain cell ceases to live in its corporate or social capacity and reverts to its old-time, unicellular mode of life. Independent again, it nourishes itself and gains strength and substance afresh.

# A STILL PROGRESSIVE TISSUE OF THE HUMAN ORGANISM.

WHETHER a higher type of life will eventually develop from humanity, whether, indeed, the human organism is capable of being greatly improved, is one of those questions which early suggest themselves to the biologist; and the answer rendered has often been in accord with the temperament of the questioner, optimistic or otherwise.

The argument and the inference from evolution are that the multicellular organisms have originally developed from unicellular forms of life; in a word, that man as found on the earth is the long-descended heir of the developmental effort,—the effort of living matter in the cell mode of existence to improve its condition and rise to the highest possible degree of intelligence and happiness.

On *a priori* grounds, there would seem to be no good reason to infer that a struggle extending through millions of years, and involving so much of individual sacrifice, may not eventuate in a correspondingly grand achievement. Evolution, in fact, naturally ushers in a moral and a creed concerning man's past and his future.

As to the further progress of the human organism, however, there are many indications which appear to controvert the affirmative view. Not a few of those whom we know to be best equipped for forming an opinion on this subject appear to hold negative views, to wit, that the human organism has long ago reached its type limits, —limits which under the most favorable conditions it could not escape; in short, that the human type, anatomically and physiologically, is now "fixed"; that improved conditions will but cause it to vary within certain unsurpassable bounds; that man will remain a man henceforward, under whatever stress of evolution, continued even for many thousands of years, or forever.

When we examine the subject historically, there is much to confirm the above view. Apparently the human organism was as perfect four thousand years ago as at present, and differed in no typical features or essentials. There seems to have been no change to indicate physical evolution within the historic period.

From a histological point of view, too, there is little to indicate even the most slowly-progressive development in most of the tissues of the body; for example, the osseous, muscular, connective, cartilagenous, and epithelial tissues. The cells of these tissues pass through a well-defined cycle of growth, and give rise to a series of growth products which vary, indeed, from youth to age, but show no secular change from generation to generation.

Moreover, the bone, muscle, cartilage, and other tissue cells of man resemble very closely those of the lower grade mammals, the types of which are even more clearly seen to be permanent and unprogressive.

Cataclysmic changes of the earth's surface, giving rise to new geodetic, climatic, and atmospheric conditions, might, indeed, if not too suddenly destructive, compel certain skeletal alterations and changes of form, both in man and other mammals, although there is the greater probability that such catastrophism would prove fatal to all well-established types of life; in brief, that the genus *homo*, or the genus *bos*, would perish off the earth sooner than develop into anything else.

There is little likelihood, however, that further evolution will be fostered by such means, even the earth itself having reached an age and a permanence of planetary type, so to speak, when surface mutations of such revolutionary character are not to be looked for. The very permanence of his terrestrial *habitat*, in fact, is against the further evolution of the human organism, or the development of anything superior in the way of organic apparatus from such causes.

The widest view of this subject of organism and evolution which we can take is so conclusive to this effect that the theory of a higher type of being than man, hereafter to come from terrestrial evolution, has been practically abandoned, even although it is apparant and can be shown on good evidence that man in his mind, his intellect, and his brain is still progressive and manifestly capable of much future progress.

The general conclusion has obtained that evolution in the ordinary sense has terminated in man, and that he is not only the latest but in all probability the last of the earth-born mammalia. A great deal in human creed, mythic, classic, and Christian, has originated here, namely, on the hopelessness of doing much better on the earth; and hence the prayerful appeal for a more favorable theatre for life elsewhere.

The apparent cessation of evolution on the earth has long been felt to be disheartening; literature is burdened with it and credulity concerning some other better state of existence has grown out of it.

But has evolution ceased? The question, which the anatomist and biologist are not a little inclined to answer in the affirmative, is exceedingly important to the morals of humanity. Have the anatomist, biologist and physiologist overlooked any point, any particular, or any capacity by virtue of which man may still demonstrate himself progressive and take heart for himself and his race?

It is the purpose of this brief paper to call attention to one important tissue of the human organism which can be shown to have been steadily progressive, and which gives no evidence of reaching, or of tending to reach, type limits.

I shall show furthermore that it is by virtue of the steady growth and development of this part of the body that man has so prodigiously surpassed all other species of mammals, made them subject to him, and overrun and dominated the whole earth. In the physical sense, the evolution of this tissue has been strangely overlooked by many, in fact most, biologists, or if touched upon, has not been held to determine the question of man's true position as a progressive mammal, compared with other species which are either unprogressive or retrogressive. For while all have abundantly recognized man's mental superiority to the lower animals, and connected it vaguely with his larger brain, this superiority of intellect has been attributed to a certain adventitious endowment of the nature of "soul," not a natural part of the organism, but an implantation from an extraneous source. Nor have biologists clearly pointed out as yet the relative truth of the matter in connection with man's rise from brute life to the estate of a world-dominant being.

The human organism, from the latest stand-point of science, is a compact, federal union of thirty or more orders of cell life. Every one of these thousands and millions of cells of which each order is composed is a more or less independent creature, possessing to some considerable extent individuality and self-direction. They are banded together, however, indissolubly, and in many situations are in protoplasmic contact by means of living filaments, so sentiently that all live and feel as one.

The thirty or more orders of cell life thus confederated have, in the progress of organic development in the past, become mutually dependent and inter-dependent one upon another, until one order cannot live without the presence and function of the others. Such are the bone cells, the muscle cells, the connective tissue cells, the hepatic, pulmonic, splenic, intestinal, spermatic, epithelial, capillary and glandular cells; an extensive congeries of diverse tissues, each containing millions of individuals and all mutually dependent on the general well-being and safety of the organism.

So far as can be judged, from a comparison of man to-day with man in earliest historic times, and man with the lower unprogressive mammals, all these above-mentioned cells or orders of cells are no longer progressive, or bid fair to grow into anything different or better. Even their abnormalities are unprogressive. There is nothing in the terrestrial environment which calls for re-adaptation; nor has there been for thousands of years. The type of these cells has become permanent.

There is a tissue of the organism, an order of cells which we have not yet mentioned, however, namely, the nerve and brain order.

Nerve and brain are not found in unicellular life; at least, not in the organic sense of these terms.

From as close a study as can be made of certain simple forms of pluricellular creatures, which are doubtless quite similar to those from which the higher pluricellular forms were originally developed, the first rudiment of a nervous system consisted of a living protoplasmic thread, thrust out from one cell to another. At first this would appear to have been a mere "feeler," but in time it came to remain constantly extended, no longer as a transient feeler, but as a permanent means of sensory intercommunication between cell and cell. This, I say, appears to have been the first attempt at a nerve system, — the transformed, somewhat modified pseudopod of unicellular life.

Cell thus felt what another cell was feeling; and when a cell in one tract of a metazoan attempted to feel what hundreds of other cells in another tract were feeling, either of joy or pain, a line of such living threads from cell to cell was established.

But, as pluricellular creatures waxed larger, and differentiation of the component cell orders began, simple filaments of protoplasm, modified pseudopodia, were no longer sufficient for transmitting sensation from tract to tract; whole rows or lines of cells were involved in the strong currents of sensation that passed to and fro, and, in time, these cells became devoted wholly to the business of receiving, interpreting, and transmitting the aggregated sensations of all the millions of individual cells of which an animal organism is composed. I seek, of course, but to outline the origin of nerve tissue in lowly pluricellular forms of life. Nerve, nerve ganglia and brain have been a development from this first tiny living filament which stretched forth from one cell to another.

I need not here review the evidences and the argument by which it is now shown that sensory ganglia for perception and reflex perception, grew up at the intersection of the primary nerve filaments; how the special sense organs took form; how at length the cerebellum came to be lodged in the forward end of the pluricellular ceature, and how the ever-increasing need of greater capacity for the sensory business of a world-roaming organism led to that enormous superaddition to the cerebellum known as the cerebrum.

What is designed here to point out is the fact that the nervous system of the human organism, particularly the cerebral portion of it, or, in other words, the tissue of mind and intellect, has always been in the past and is to-day a progressive tissue. It came into existence, as brain, in response to a necessity on the part of the organism for greater protoplasmic capacity, for the reception and utilization of intelligence. That necessity and that stimulus still exists and grows constantly more urgent.

Bone and muscle cells have developed to the extent of the necessity which led to their differentiation; the incentives to locomotion and organic support remain the same, unchanged in character; hence, bone and muscle cells long ago reached the acme of their development. The same is true, or true in large part, of every other tissue of the body, save the encephalon. The brain is still forced to develop and grow larger in response to constantly changing conditions incident to the world's growth in knowledge. Certain tribes, races, and peoples, it is true, adhere to habits and modes of life largely unprogressive, and as a result show little brain change from generation to generation. It is not so, however, with the westward-moving peoples of the dominant races, — the nations who think and invent. Science is the agent of brain growth. To think, in the true sense of the word, signifies brain development. New inventions stand for cerebral evolution. The changed sensory experiences, too, which result from new inventions, tend to alter the protoplasmic arrangement of the brain, and add to its capacity for growth. In America, to-day, we see heads of varying sizes and shapes, not only the types emigrant from Europe, Asia, and Africa, but types and sizes unknown before in any country. There is actual brain growth among us. A new variety of intellect is being developed.

A comparison of the earliest human skulls, found in ancient caves, tombs and mounds, with those of individuals of the present age, shows that on the whole there has been growth of brain as well as a perceptible alteration in shape, in favor of greater intellectuality. Brain has grown greatly in size and improved in form during the last eight or ten thousand years, — a period of time relatively brief when considered in comparison with the developmental epoch of mammals.

Prehistoric skulls are smaller and less prominently developed, frontally, than those of our own epoch. The same general truth is exemplified when the skulls of existent savage tribes are compared with those of individuals from the highly civilized and progressive nations; there is less of that higher frontal development in savages, which we always find associated with the growth of intellect, and this even in instances of large individuals, where the skull is very massive and capacious. Acquired knowledge and the sciences tend constantly to increase the bulk of the brain and modify its form; in a word, to render it a progressive tissue.

This proposition is still more grandly exemplified when the evolution of life on the earth is contemplated as a whole. In early metazoic life, brain was scarcely more than initiated. The lower vertebrates have small brains. But in the quadrumana the human brain is found to be outlined in type and form. From this order of mammals the progress of the human brain can be readily traced.

Nor can it be doubted, even although our microscopes fail to show the fact, that the brain tissue is receiving a progressive, internal development, corresponding to the intellectual growth of humanity.

For the human brain to-day is the protoplasmic co-relative, the material counterpart of the entirety of human knowledge; and in future as science increases its range and its acquisitions, there cannot fail to be greater and greater stimulus to brain growth and increased cerebral capacity.

It may not be wholly irrelevant here to allude to certain recent attempts in the province of surgery to open the sutures of the skull for the purpose of giving the brain greater room therein. These first rude efforts may be prophetic of measures which will be resorted to as time goes on to facilitate cerebral development, since it is already known to many specialists in brain disorders that congenital lack of room for the brain inside the skull is a serious incident in the lives of many persons, particularly where for several generations there has been a tendency to intellectual pursuits.

So surely as there are new things to learn in the great universe around us, just so surely will the brain of man go on growing and developing greater capacity for the reception of knowledge. It is in this respect and in this tissue that man has not reached the acme of his powers, and that evolution has not ceased.

And this aspect of his future brings us more clearly to a contemplation of his anomalous position on the earth to-day. From some reason — either a hint dropped in his earlier ear by beings from some outer orb of space, or in the natural order of his terrestrial development — man left the rank of his brutal mammalian congeners and began to use his brain. As a result, his brain grew and has entered upon an era of development the limits of which no one can foresee. In consequence we find this tissue to be still progressive, but associated in the organism with a score of other unprogressive tissues which tend but to pass through a fixed cycle of growth and decline. It is this condition which affords the key-note and the explanation to all his strange creeds, aspirations, superstitions, hopes, and fears; his optimisms and his pessimisms; his gods, his christs, and his satans. A demi-god engrafted upon a brute organism which drags him through mire to death and despair.

And this is that riddle of the Sphinx, that fateful interrogation of the ages which he has to answer: Will the progressive, still developing brain acquire such knowledge and obtain such mastery and such control over the forces of nature as to "redeem," regenerate, and renew at will the other unprogressive tissues with which brain is yoked in the organism, and which at present condemn it to a brief lifetime with them? Can the progressive tissue redeem and save the unprogressive tissues?

# SELF, CELL SELF AND MULTICELLULAR SELF.

THERE is no such thing as protoplasm in the sense that this substance has usually been described and conceived of, namely, as a homogeneous, structureless compound of uniform chemical composition, in which life manifests itself, and of which the cells are so many little measures.

This conception, I say, is largely illusory. What appears to be the protoplasm of a muscle cell is a substance different from what passes for protoplasm in a nerve cell and its processes; and the same is true in respect to other kinds of cells which, with their products, make up the component tissues of the human organism.

Nor when we come to the nuclei of two such cells can we say with any greater certainty that both are composed of anything like homogeneous protoplasm. For these nuclei in turn appear to be almost equally different, not only in their sentient attributes, but in physical structure.

I have before me, under high microscopic power, the nucleus of a cell from the anterior horn of the gray matter of the spinal cord, near the fifth pair of cervical nerves, which by a lucky stroke of the microtome rather than skill in using it is cut through, showing within it a nucleolus, or chromosome, which in turn is crushed, exhibiting far within still other rounded, light-refractive bodies which are apparently of the nature of nuclei within the nucleolus.

And looking at this wonderful triple incarnation of the vital impulse, I can easily believe that these minute penetralia are but the outer temple of shrine within shrine; that there is another within that, and still another, more esoteric.

With this suggestive object lesson before the eye one can easily conceive how complex a thing the cell of life may be; that it is a development outside of a development, four times repeated. Four times! Who knows but that it is a hundred times repeated before the inner shrine of the vital plane or attenuation of matter is reached! This indeed is not proven, not even theory, yet so probable that the converse proposition is improbable; and the doctrine of "gemmules," or that latter doctrine of "biophors," "ids," and "determinants," is reflected forth from this fortuitously cleft cell with an added air of credibility.

We have chemical knowledge of particles of matter so minute that a quadrillion of them aggregated would not equal in bulk this gray cell which lies ruptured on the slide before me. It is easy, therefore, to conceive of such *ids* and *biophors*, one within another, each a hundredfold less in size than the one which contains it; of cell within cell, each a development of the nature of an organism from the one within it. We see clearly that something of this sort takes place in the growing embryo; that evolution on a grand scale has occurred from minute and invisible "determinants" (for Weismann's terms may be used in a general sense) far up to the visible chromosome, or to the granule which is the embryo of a cell.

It is this complexly wrought embodiment of life within life which has been named protoplasm! But it is much as if we took herring, salmon, whales, lions, elephants, moles, sequoias, oaks, fungi, all sorts and species of living things, large and small, vegetable and animal, and having cast them by millions into some huge Noahchian receptacle, named the conglomerate "*meat*."

We have to look deeper for even the proximate incarnation of life.

Matter does not become *living* matter or "protoplasm," in any correct sense, until a certain *subjective* property which inheres in it begins to find expression in the unification of particles, *i. e.*, the aggregation of many particles in a union which *objectively* behave as *one* particle, and *subjectively* become a *self*. Such a self is a cell, or rather the inmost nucleus of a cell. Marking everywhere this property and trait of matter to exhibit subjective selfhood, we infer that there must be, ultimately or originally, an intimate plane or state of material attenuation where the very minute particles are each and all so many minute *selves* capable of self-motion.

This hypothesis, indeed, is the key-note of modern biological science. It is the scientific theory of cosmos, as contrasted with the theological theory that matter is dead matter acted on by alien forces.

It is as if the millions of material particles in a cell nucleus — each particle possessing what Clifford termed "the elements of feeling," *i. e.*, a sentient-constant — blended and harmonized these their sentient properties, by virtue of some inherent relationship, so completely as to set up a centre or central axis of self-consciousness, thus becoming a personal being, a self, an ego. It is this symbiotic relationship of the component particles of a nucleus which constitutes it a living creature. For thus conditioned, these particles are, for the time, within the cordon of subjective being; they have become a self; and to all of them, thus united, the rest of the universe is objective; everything within the nuclear cordon is subjective. It feels, and as it moves is self-conscious; but everything outside that cordon, it perceives to be external to itself, *i. e.*, objective.

It is this self-continence, indeed, which constitutes the test of life. What takes place in reality is that these unified millions of material particles have, in a degree, shaken off their relationship and allegiance to the rest of the material universe, and entering a league one with another, are now acting from a centre or an axis of their own, in defiance, so to speak, or independent of the aggregations of objective matter around them. They have banded and set up for themselves; and it is this their *altered behavior* which we term " life." They have converted their initial energy, once displayed wholly as gravitation or chemism, to a new use, to wit, life. Subjectively, this nucleus of banded particles is self-conscious and possesses *free* will. Objectively, it is seen, by others, to be automatic. That is to say, it acts from its own centre of personality, instead of from the centre of the earth, or the centre of cosmos.

Where an inanimate mass of the same size as this nucleus, or, in other words, a dead nucleus, would roll inertly down hill, this living, subjective nucleus has the power to stop suddenly, — to turn and go back up hill. It is not asserted that chemism and gravitative energy are not concerned in this process of going back up hill, but that there is exhibited in the living nucleus a power to arrest gravitation, inaugurate chemism, and alter the common course of objective phenomena. There is a display of free will, which means nothing less than a display of energy from the subjective side of matter and from a new axis of being.

This question of free will in matter, as opposed to the doctrine of fatalism, is an important and interesting one, and one which affects life and morals radically. It has been discussed from a thousand points of view for the last three thousand years, and never definitely settled. It is still *sub judice*, and obtrudes itself as a doubt and a menace to every one who attempts to think for himself. Is there really, and at bottom, any such thing as personal freedom?

The microscopical study of living matter, from its bio-physical side, brings us at last to a solution of the enigma, and places the modern biologist in a position to speak with authority. The facts in hand warrant the assertion that *free will* in man is no myth, no self-deception of our imperfect mentation, but a fact, a truth of nature. From *the subjective side* of living matter, in the nucleus of the cell, there is exerted an elective power, albeit faintly and intermittently, which constitutes that nucleus a free moral agent in the universe.

Multicellular self is a consentience of the many cell lives of which an animal organism is made up. It is necessary to bear in mind, however, that the human self, or intellect, is developed largely from the confluent sentience of the cells of but a single tissue or organ of the body, namely, the brain and nerves.

In a paper which precedes this we have pointed out the protoplasmic connections of cell with cell in the brain, and called attention to the significance of the wonderful net-work of fibrils which maintain sentient contact throughout the organ of intelligence. And in a former volume, published in 1892, we spoke of the causes which early in the development of metazoans have led to the elevation of certain cells to the function and office of brain and nerves.

"Very soon after creatures composed of many cells (metazoans) were developed from groups of unicellular life, the necessities of locomotion in the struggle for food led to the differentiation of certain tracts of cells as bone and muscle, and finally to the development of the entire apparatus for mechanical movements.

"Simultaneously, too, another peculiar species of differentiation began to be necessary, namely, a special tissue, whose office should be that of intercommunication between the different associated cells and tracts of cells which were thus assuming more and more diverse offices, and becoming somewhat different in character, one from another. It was thus and for this reason that a nervous system began to be needed and hence to develop; for the plastic, living substance has always shown a faculty of adapting itself to widely variant functions and modes of living.

"Certain cells began to take up the business of receiving sensory influences from outlying cells which were hard-pressed or in want of food, and of transmitting such sensory influences to contiguous cells. In short, certain lines of internal cells began to take upon themselves the task of conveying the sensations of others from one tract of the cellular mass to another tract, and of interpreting the sensation received from one tract to the comprehension of the sentience of another tract, so that action, within its sphere of action, would ensue in the second tract. In addition to their own sentient economy, these lines of cells in the incipient nervous system took up the function of common carriers of *sense*, and also the office of interpreters of the sensory language of one order of cells — if I may borrow the figure — to the different language of another order.

"Thus, humbly, as we conclude from observation of low forms of life, did the nervous system, or tissue of intelligence, begin to develop. Primarily there was but one or two simple thread-like lines of cells attempting the office of transmitting feeling, and succeeding indifferently at first; but as animals increased in size, the business of telegraphing sensation grew, and a net-work of lines was developed. Sensation was going both ways, and soon the necessity of a common centre to which sensory influences could be brought, and thence distributed to their proper destination, was forced upon the nascent, sense-conveying cells, and a ganglion, or little brain, came into existence. The confusion, too, resulting from counter currents of feeling soon led to the formation of double lines, one for transmitting sensation inward, the other for transmission outward; and thus the divisions of sensory and motor nerves were inaugurated to and from the little brain centre, which presently assumed the function of deciding upon the merits of transmitted sensations and responding to them by a message from its own sensibility.

"Nerve ganglia multiplied as animals increased in bulk and attempted larger movements; and in time, to avoid confusion and get the organic business done, one ganglion was obliged to take the lead and keep order among the other ganglia, to decide between them when they got at variance, and generally to take the office of head ganglion.

"Thus, in time, a larger and capitally important ganglion was raised up into prominence to perform the function of oyer and terminer, a cerebellum, and finally a cerebrum, — a mass of highly organized cells which have, from long use and inherited development, the capacity for intelligent perception and thought."

Without any attempt to present a consecutive line of examples to illustrate the progressive development of the cerebro-spinal system, the above outline indicates the principle upon which this family of cells has come forward to occupy its present grand prominence as exponents of intelligence.

In treating of the cells of the brain as individual, living creatures, it may be well to set forth more explicitly what their *status* of intelligence probably is, and explain how far they may be regarded as sentient. It is not claimed for any unicellular creature that it possesses rational powers to such extent as is evinced by an organized tract of cells like that of the human brain. For in the human brain we find a great number of cells of four or more varieties, devoted some to memory, some to reason or the comparison of experiences, some to vision, some to hearing, and some to the estimation of odors and flavors; and it is the sentience and experience of them all which is combined in the human intellect. Yet from observations of unicellular life we find, as in the case of ciliates, that it is quite possible for a single cell, no larger than many of the brain cells, to possess not only sentience, but to acquire the data of memory and to act from its previous experience. Many forms of unicellular life, indeed, behave *rationally;* nor is there reason to suppose that the cells of the brain are less capable of perception and of memory. In the brain, however, cells of different tracts are concerned with experiences of particular kinds, some recording the data of vision, others the data of hearing, and still others collating and comparing such data. It is probable that a cell of the tract or group in the area of vision, for example, is largely occupied with depiction of visual imagery, and becomes a kind of living, sentient specialist, or expert, in colors and scenery.

None the less it is a sentient creature, with its own internal economy of nutrition and growth. In a word, it is a sentient self. It perceives, lives, and acts from its own personal point of view, for its own behoof and welfare. This much is quite certain. It is a sentient creature, and within its limited sphere has acquired a kind of wisdom of its own. More we cannot predicate of the individual cell. It is a pigmy of a limited degree of intelligence.

The animal organism has sometimes been compared with a "culture" of micro-organisms, or bacteria. Such "cultures," according to Maupas, have their period of youth and old age, requiring admixture with separate cultures, or the action of other agencies from outside the culture, to effect a regeneration.

The comparison of the animal organism to such a "culture" is suggestive, but, to render the cases parallel, should be specified more exactly.

In a culture of micro-organisms the individual cells, as a rule, move about freely, and are not, as in the animal organism, immovably fixed in the substance which they produce; nor are they permanently connected together by sentient protoplasmic bonds. Often they communicate by means of cilia, pseudopodia, or filaments which are thrust forth temporarily, as they chance to approach each other; but they do not remain in constant consentient communion, as is the case with cells in the animal organism.

In the animal organism the cells give rise, from katabolism, to waste products,—urea and carbon dioxide, for example,—not unlike the ptomaïnes from a culture of bacteria. But instead of growth by increase of numbers merely, as in the case of bacteria in a culture, the body cells grow by means of extended "alloys" of their cell protoplasm, producing, for example, muscular fibre, cuticle, bone, sinew, nerve fibre, etc.; and it is by the compacted aggregation of these products, or protoplasmic alloys, that the organism is made up.

Further, instead of one species or variety of bacteria, as in the case of a culture, the cells of the animal organism comprise, if classified according to the different products which they give rise to, thirty or more species and varieties. It is, in fact, as if thirty cultures had united to live in company, and benefited mutually by the confederation of their products, and even of their ptomaïnes.

Nor does the comparison, as thus extended and specified, in any manner account for the consentience of one of the groups of cells in the animal organism. The explanation of this latter phenomenon, long considered mysterious and indicative of an unknown principle in nature, is found in protoplasmic contact of cell with cell. In the brain the cells put forth processes or tentacles which bring each into sentient contact with its neighbors. This condition does not obtain nor prevail in a culture of micro-organisms, although sometimes, at particular seasons, a certain clustering together of all the individuals of a culture is observed, followed by combined action of the whole company, indicative of a kind of imperfect, rudimentary personalization of the culture.

For even in disjoint unicellular life it is possible for numbers of infusoria, ordinarily leading distinct individual lives, to band together and exhibit consentience, by virtue of cilia and flagella interlaced and intertwined. To accomplish this result it is only necessary that there shall be established direct protoplasmic touch and continuity between individuals. The filaments which micro-organisms emit from their bodies at such times are part and parcel of the component protoplasm of their cell bodies. An actually living continuity is thus set up; and this appears to be all that is necessary in order that two, a hundred, or a million of cells may "pool" their hitherto distinct individualities in one.

This, indeed, is what occurs on a perfected, continuous, and grand scale in the animal brain, giving rise to multicellular self. When two or more cells are protoplasmicly in touch, so that there may result consentient feeling between them, the two or the million no longer exist as separate, self-conscious units, but as one. The axis of self-consciousness in the cell is shifted or exchanged for a common axis for the two or the million cells.

According to the present sentient hypothesis of matter, every material particle possesses the elements of feeling. Every such particle is a minute self. In a cell a million or more sentient particles have grouped themselves in such peculiar relationship that they are able each to surrender self in the union of selves.

In certain species or groups of unicellular life occasional instances are observed of the temporary union of many separate cells in a common life which endures for a time and then terminates, by the disbanding of the cells, each going its separate way as before, resuming its unicellular life.

In the animal orders, man, for example, personality (the ego of metaphysicians) chiefly pertains to and is resident in brain and nerve tissue. Brain and nerves constitute a tract of cells of a higher order than those of the other organic tissues, and are remarkably closely connected, cell to cell. The protoplasmic contact of the cortical cells of the brain is indeed marvellously perfect; nor can there be doubt that the coherent sensibility and unified intelligence of this grand family of cells rest upon this sentient protoplasmic contact of cell with cell.

Something analagous to this protoplasmic connection and contact is seen when very simple forms of unicellular life multiply, by constriction and division of one cell to form two. In some cases the cell or amœboid creature is seen to send forth a bud containing a part of the nucleus, which increases in size until nearly or quite as large as the parent cell, remaining connected with it only by a small neck or isthmus of living matter. Yet the two nearly sundered parts still continue to live as one, actuated manifestly by a common impulse and a common self-consciousness, emanating from a common centre or axis of life. But immediately the tiny connecting neck of living sentient matter is severed, each part becomes a separate self, sentiently influenced no longer by the other. Till the sentient link was severed there was but one self, one creature. When severed there are two selves, two creatures. Till severed the two parts were mutually *subjective;* when severed each becomes subjective only to itself, and *objective* to the other. The severing of this protoplasmic, sentient filament terminated the subjective relationship between the two parts, and thrust each forth from the other into the realm of objectivity.

Protoplasmic continuity, or even close protoplasmic contact, appears to constitute a bond of common sentience and of mutual subjectivity.

There may be, probably are, degrees of this relationship. The protoplasm of the cell body, outside the nucleus, does not probably maintain the sentient, subjective relationship so perfectly as the nuclear protoplasm. It may be that the subjective relationship ceases in a degree when the nucleus divides, but only in a degree. The point to be kept in view is that protoplasm, even alloyed to some extent, constitutes a cordon of subjective being around the entire number of material particles which are included in it, and that this cordon of subjectivity is projected even when, as in the case of the dividing cell of amœba, the component protoplasm is nearly divided in halves, drawn out and widely extended. So long as a connecting, living filament remains, the protoplasmic mass is one creature, one self, one self-conscious personality.

In a certain loose way the various species and orders of cells which, with their cell products, compose the human organism have been compared with the classes of citizens who make up a nation, and the national life to the life of an animal organism.

It is instructive to see how far this simile holds good, under what protoplasmic conditions a nation might exhibit personal life, and what relationship of citizen to citizen would need to exist in order that, surrendering each his individuality in part, or for a part of the time, a unified, self-conscious national life might result.

Let the seventy millions of citizens of the United States or the forty millions of Great Britain be compared with the living cells of the human organism, or, to make the comparison a little closer, with the cells of the nervous system and brain of a man. To carry forward the simile properly, every citizen, of whatever trade, occupation, or profession, would need to be represented as almost wholly deprived of locomotion, and seated, as if at a desk or table, in one place, where food and the material for his work were brought to him in ducts and tubes. Still further, it would be necessary to conceive of them all as built in and incased by the substances which they manufacture. Further still, and most essential of all to the truth and pertinence of the simile, we should need to depict every citizen as connected with his neighbors and through them with every other citizen, by cables, bands, or cords of sentient living matter continuous with his own living substance. We must picture, too, the more prominent class of citizens as having thrust forth immensely long tentacles, forming nets of this same sentient matter, extending long distances from their bodies, and lying in close contact with similar tentacles belonging to hundreds of their fellows, in order that they may feel and literally *sense* all that they do or think.

If this condition of things existed throughout the nation, we should undoubtedly find the individual citizens living as one enormous, national person. In place of seventy millions of individual men and women, we should see them unified in a self-conscious national life. Such a nation would act and conduct itself among other nations as a Personal Being.

Upon a lower plane of inorganic relationship of particle to particle, in the atomic sense, it is possible that such a unified personality possesses the universe, answering to the indefinite conception of deity. Gravitation has been held to be the lowly organized personality of cosmos, expressing itself in natural phenomena. Hartmann, in his "Philosophy of the Unconscious," appears to have grasped some such conception, which, however, he immediately perverted to the exigencies of an immoral philosophy.

# LONG-LIVED CELLS AND THOSE WHICH DIE YOUNG.

BIOLOGICAL research has made progress and thrown light on several important questions since August Weissmann first published his theories of the germ-plasm, heredity, and death, 1881–1889; theories which contain so many facts of research, so much of truth and evidence, that biologists have often been led to overlook the cardinal untruth which vitiates his conclusions.

Maupas, too, has given us the valuable results of a very extended series of observations on sexual and asexual reproduction in unicellular life (ciliates).

Van Beneden, Waldeyer and His, Hertwig, Flemming and the veteran Haeckel, Whitman, Wilson and an ever-increasing number of well-equipped observers have also contributed many facts tending to modify the cell doctrine as held ten years ago.

Weissmann's hypothesis has already become popularized. He was not the first who pointed out the fact that in the asexual reproduction of infusoria, death is apparently absent, save from accidental causes; or, in other words, that infusoria possess a species of immortality; but he amplified the ideas of Balbiani and others, and rendered them pertinent by contrast to the case of multicellular organisms, which are seen to become senescent and die as a result of old age. Assuming that the cell type of life is essentially or potentially immortal, and that multicellular creatures age and die from exhaustion of the somatic or body cells, as a general result of their differentiation to organic uses, Weissmann pointed out that in the reproductive organs of animals there is conserved, or rather reserved, a kind of primitive cell life which proliferates continuously by fission, from generation to generation, resembling in this respect a deathless colony of infusoria.

To this deathless group of reproductive cells, descending continuously from parent to offspring, he gave the name of the germ-plasm, to which heredity is restricted; and as a necessity of the theory, denies that acquired characteristics of the individual animal are or can be transmitted to offspring. His assumption was that natural death had not entered the world until unicellular life began to unite in permanent colonies and thus develop multicellular organisms, nor ever would have entered it had this primitive unicellular type of life remained the only type. According to Weissmann, the differentiation of cell life which was necessitated by the wants of a large multicellular organism opened the way to sexual reproduction, as a means of remedying the deterioration and exhaustion incident to multicellular life.

By induction of his general argument from these premises, Weissmann's next assumption is that the animal organism lives only and for no higher purpose than to produce offspring; and therefore that when offspring have been produced, or, in other words, when the germ-plasm has been brought forward in the organism to reproductive perfection, there no longer exists any proper reason why the organism should live longer; and hence it dies. More succinctly, the death of the organism is then the proper natural event, the entire purpose of individual life having been subserved; and here I wish to predict that this assumption, namely, that reproduction is the prime object of life, instead of a means merely of preserving life, will prove the fundamental error on which his entire hypothesis, nurtured with such scholarly labor, will ultimately founder.

Briefly, he holds that in the primary unicellular type of life, death does not occur naturally; that with such infusoria, reproduction is asexual, being accomplished by fission and cell division simply; that metazoans and multicellular animals, generally, die by reason of the extended differentiation of the original unicellular type of life to tissue uses resulting from organic life. Weissmann, indeed, appears not to be wholly clear in his statement of the causes of general systemic death. At one time he speaks of death as resulting from the sexual mode of reproduction; at another, from the differentiation of the somatic cell life to the highly specialized modes of life and growth, necessitated by the wants of the animal organism; while, otherwise, he affirms that the organism, as a whole, meaning all the confederated groups of somatic cells, dies because there is no longer any reason for it to live, it having fulfilled its mission in bringing forward the germ-plasm.

Meantime, M. Maupas has contributed facts from a remarkable series of observations, which controvert the first two of Weissmann's premises. From observation of colonies of ciliates and other forms of unicellular life, continued through five months at a stretch and resumed at intervals for several years, extending over not less than two hundred generations of individuals from a single colony, he has demonstrated, quite conclusively, that reproduction in unicellular life is of two kinds: asexual, by simple fission and division of one cell into two, and also sexual; that after a certain number of generations of a sexual reproduction, the ciliate colonies become small and enfeebled, rendering it imperative that different colonies, not akin, should come together, sexually, for regenerative and restorative effects. Of these sexual congresses of the ciliate colonies he has made minute observations, and described at length the conjunction of the cell nuclei.

Maupas's observations would seem to demonstrate that not only does sexual reproduction occur in ciliates and other forms of unicellular life, in opposition to Weismann's theory, but that if, after a certain number of generations, by asexual reproduction, diverse colonies are unable to meet for sexual conjunction, the generations grow constantly smaller, more feeble and senescent, until at length the individuals become no longer able to meet sexually, and the colony dies, literally, of old age.

Two, then, of Weissmann's assumptions would seem to be invalidated, namely, that infusoria are immortal and that sexual reproduction is peculiar to multicellular creatures. Unicellular forms of life grow old and die of senescence, as do multicellular forms; nor does there seem to remain on these grounds any further logical strength in his third deduction, that the somatic cells of the animal organism die in consequence of differentiation from their pristine condition of unicellular immortality.

I have before me, as I write, three pyramidal cells from the brain of a woman dying at the age of one hundred and three years and two months. These three cells are probably one hundred and three years and six months old; for histologists now generally concur in the opinion that the cerebral cells are not renewed, and live as long as the organism lives. If Maupas is correct, there is no likelihood that any one individual ciliate, or other protozoan, or colony of protozoa, has ever survived for a tenth of the years which these venerable brain cells have outlived. It would appear, therefore, that the lifetime of a cell in the human body, so far from being limited or shortened by differentiation, may be prolonged by it; and that the most highly specialized cells are the longest lived of any known to exist. In the brain of a sperm whale, for example, may be found cells which attain an age of from two to four centuries.

In regard to differentiation it should also be added that although many of the body cells, particularly those of the nervous system, do not proliferate, either asexually or sexually, it can scarcely be said positively of them that they have lost the power to do so, but rather that their position in the brain or other tissues does not call for nor admit of reproduction.

The error of Weissmann, and of many other prominent histologists of our times, is deeply seated in their premises. They assume that the animal life is but the concrete product of the congeries of cell life of which it is composed; that it is, and must continue to be, merely what the component cells would make of it. This is true only in a very partial sense, the real fact being that the life exhibited in the organism, particularly the human organism, has already developed self-determining power which dominates cell life, and bends it to its behests, making certain species of the tissue cells short-lived, and certain others long-lived. From the ovum upward there is self-direction of a higher order than is exhibited by the cell life of any one tissue; an intelligence which is the organized result of the brain life as a whole.

It is this unified, confederated life which constitutes the dominant personality of a human being, and makes the component cells its plastic instruments of growth and sensation. It is time to cease regarding the human organism merely as a cell republic, or a cell colony. An animal organism is all this, and vastly more. It is more than a confederated life; it is a confluent, personalized life of far higher sentient coefficient than cell life. There is no reason to think that cell life is *intelligent* in any similar degree, or upon any such plane of intelligence, as is the human brain as a whole. The human mind excels cell mind in something more than volume. Thinking is an act, or an exercise, of the entire brain, not the effort of the cells themselves; and it is from thought that intelligence arises. Thinking is, indeed, a process of pan-cerebral effort, in which the cell figures only as a seat of sentience.

It is the intellect, arising from mental operations, which constitutes that higher, controlling, and self-determinant power that renders the somatic cells long-lived or short-lived, in obedience to its higher needs.

The lifetime of the cells of the human body, meaning the age which the cells composing the various tissues attain, individually, becomes an interesting subject of inquiry, considered with reference to the longevity of man.

Unicellular life was the first and for very long periods the only type and condition of life on the earth. Multicellular forms of life came on the stage later. For a period, indeed, which, compared with the period of multicellular creatures, is as four to one, unicellular life was the all-prevalent condition; and even in the present age, micro-organisms constitute by far the greater part of terrestrial life.

Hence, in the broader light, we have to regard the ancestry of the orders and groups of cells in brain, muscle, and bone as so many once free cells not unlike bacteria, which have combined, become civilized, so to speak, and united in one great commonwealth.

Matter, meaning the material "atoms," or particles, of which the universe, living and non-living, is composed, is, under every known test, indestructible. Every particle of it, moreover, possesses a certain primordial property, from which it is never known to be divested or separated, and which causes motion in all its forms and modes, including gravitation, chemical action, and, beyond any reasonable doubt, life. The cell of life, which is a minute, individualized dot of living matter, would therefore appear to possess the elements of immortal life, potential, since the term "indestructible" as applied to a particle of matter is the synonym of the term "immortal," applied to a cell of living matter.

Under ideally favorable conditions of nutrition and environment, a perfect unicellular creature might live immortally; that is to say, the protoplasmic molecules might be formed and recruited directly from contiguous non-living particles.

The assumption of Ehrenberg and Weissmann, touching the immortality of infusoria, would therefore, in such an instance, be found true.

In point of fact, such ideally favorable conditions of nutrition do not exist on earth; infusoria like metazoa age and die, from errata of nutrition and the general vicissitudes of their lives. The larger multicellular creatures encounter greater vicissitudes; for the larger and more complicated an organism is, on a theatre of life so imperfect and beset with accident as the earth's surface, the greater are the liabilities for vitiation. Within the organism, too, the cells are exposed during nutrition, oxygenation, growth and locomotion to constant vitiation and accidents from which they suffer and age.

Hence the length of life actually attained by cells in the human body is a matter of interest in our inquiry, and one from which certain significant inferences can be drawn.

In the superficial layers of the skin or epidermis the microscope reveals the presence of an innumerable multitude of dry, dead cells, so many minute scales, which form a coat of armor for the living cells beneath. As rapidly as these armor scales are worn or torn away in the battle of life, other similar scales from below take their places; these are the dead bodies of cells that have perished from exposure, after being brought too near the outer surface, — exposure to cold, heat, mechanical violence, and the action of air, water, and other agencies of destruction. But as they neared the, to them, fatal outer surface, the hardships of their situation caused them to fortify their living nuclei by the abstraction of silicates from the blood, particles of adamant which were mingled with the outer growth of their protoplasm; and when the inevitable mortal moment comes, their lifeless bodies serve for a time as a barricade and a shield for those in their rear. All this innumerable host comes into existence, either by growth and fission of one cell into two, as is still taught in some text-books of histology, or else by development from embryonic "granules," the entire stock of which in any one person is inherited in the embryo from parents, and which therefore tends to diminution throughout life.

We are not here entering on the question of the origin of these cells, — the origin of the "granules" or germs from which they develop.

That question is still complicated by several opposed theories. It has been held that the development of granules is limited to embryonic life; that is to say, that the nuclear granules which subsequently, in adult life, become cells of the epidermis all came into existence before birth.

The view has also obtained a certain relevance, that a layer of cells of the corium, during adult life, remain parent cells for the production of granules, as in the embryonic period. The tendency, indeed, is toward the conclusion that what appears as a cell in the tissues of the organism is a development from an almost inconceivably minute germ which had its origin in the parents; and that a certain variety of cell gives birth to such germ elements throughout adult life, not in the sense of multiplying by simple fission and division, but in the sense of being the bearers and holders of a multitude of the germs of cells which are developed and exuded in response to the needs of the bodily life.

When we examine the cells of the reproductive tissues, indeed, there is much which lends support to these theories; spermatazoa and ova are not, strictly speaking, cells arising from fission and division, but resemble rather a class or order of *emitted* cells not like those which emit them. The length of life of these cells is known to be relatively short, — a few hours, days, or months.

When, however, we examine the cells of other organs, the liver, for example, a quite different condition of cellular life presents itself; for here, after adult age is reached, the true hepatic cell has a lifetime co-existent with that of the entire body. The same is probably true, in the main, of muscle cells, when muscular growth and development is normal. So of all the more highly differentiated tissues, as pulmonary tissue, renal tissue, *et al.*

Very markedly is this true of brain and nerve tissue. The pyramidal, Purkinjé, and multipolar cells of the gray matter of the cerebrum, cerebellum, and spinal cord have a lifetime conterminous with that of the whole organism; that is to say, they may live each a hundred years, or more. In starvation and exhaustion from hardship, also, these are the last cells of the body to give visible evidences of suffering and yield up life. Whether the cells of the nuclear layers of the brain are as long-lived is not so clearly known, but the presumption is well supported that these all survive as long as the body lives; and this is true of the outstanding nerve ganglia, where the specialized cells are equally long-lived.

In the case of gland cells, however, the salivary and intestinal glands, for example, it is still debatable whether cells are secreted bodily away, new cells taking their places, or whether the cells characteristic of gland tissue develop within themselves a certain kind of cell from a stock of granules, which secondary cell is emitted when the gland is in activity. Further observation is requisite to determine this point. In the case of mammary glands, in time of lactation, nuclei of cells pass into the milk, and are thus thrown off rapidly from the tissue; but we cannot yet say with certainty that these are the true gland cells, or an emitted cell, maturated from a stock of granules which the gland cell proper holds in store.

In blood, — for blood is, in a sense, a tissue of the organism, — the consensus of opinion is that the red and white corpuscle cells are not long-lived; but that from their office, implying contact with the air and with morbific matter of the organism, they age rapidly and are replaced by new cells, a few days, or a few weeks at most, sufficing to terminate their individual lifetimes. And while it is not yet demonstrated that the nuclei of the red corpuscles die in the spleen, or do more than slough off their deteriorated outer coats, it is yet generally true that as a tissue cell the sanguineous corpuscle is short-lived.

It is apparent, therefore, from even this brief summary that the cells of which the animal organism is composed have no intrinsic standard of longevity; that they may live a century or may live but a few hours, according to their environment and the hardship which they encounter. The species of multipolar nerve cells is so protected from injury, so equably housed from cold and heat, and so well supplied with nutrient matter that, although its functions are onerous and its labor heavy, it yet seems able to survive one or even two centuries, while a cell of the exposed cuticle, or buccal epithelium may perish in a few days.

This, indeed, is evidence of a cheering sort, as going to show that practically the cell of life may live indefinitely, if the conditions of life are made sufficiently favorable; that death and dissolution come not from any intrinsic law of its life, but result from hardships and accidents; in a word from conditions all of which are susceptible to amelioration.

It is interesting still further to compare the lifetime of the cells of that master tissue, the brain in man, with other mammals. Reckoning the extreme age of the pyramidal cells of the cerebral cortex in man at a hundred and fifty years, the corresponding cells in the bear, dog, wolf, and rhinoceros are found to live but twenty years; the house cat, fifteen years; the sheep, twelve years; the cow, fifteen years; the squirrel and mouse, seven years; the hare, eight years; the pig, thirty years; the horse, thirty; the eagle, crow, swan, and raven, one hundred; the camel, a hundred; the elephant, a hundred, or, on classic authority, four hundred; the tortoise, a hundred; the pike, three hundred; the dolphin, thirty, and the whale two hundred, or, according to the theories of whalemen, from three hundred to four hundred years.

These estimates, approximately true it is likely, serve to confirm the deduction made above, that the protoplasmic cell on which all organized life depends has no arbitrary limit of life, but may live for an hour or for two centuries, in accord with the behests of the organic life as a whole; in short, that its life is regulated and dictated by the greater life of which it is a structural unit.

We have need to break away, summarily, from the cell doctrine as taught for the last half century, namely, that the cell is arbiter of the organism's life and destiny. Our observations show the reverse to be the fact. It is rather the organic life as a whole which is the arbiter and determinant of the histological cell life.

In the human organism, the life of the brain and spinal ganglia normally regulates the life periods of the cells of all the adjuvant tissues.

It is only in a minor, subordinate degree that the tissue cells, from their ancestry, restrict life. Within the organism there has developed from these subjected cell lives a grander life which redacts to rule and to dictate whether they shall live for a day or a century.

# IS DEATH AN IRREMEDIABLE EVIL?

ONE of the oldest questions which man has ever asked, asked in every age and century, asked by mouth of Hebrew seer, Arabic astrologer, Magian sage, Parsee, Hindu, Taoist, Alchemist and the more modern romance maker, is yet again asked by the biologist of to-day, in the light of recent researches touching the vito-chemical properties of matter, exhibited by the protoplasmic molecule.

Can man by any means escape death? By mastery of bio-physics and the regulated control of living matter may he maintain his life in the teeth of Time, stem the onset of Old Age and live on in perennial health and strength?

A dying world turns but a smile of sad derision upon such a question. Yet a new-born hope is in the world, and there are many who think that within the next twenty-five years biology will have possessed itself of the secret of protoplasmic life, and that these vital activities of nutrition and waste may be gauged, directed and promoted at will; that complex, frail, and delicate as are the tissues and co-relative organs of the human body, that wonderful *vis medicatrix naturæ* which can be summoned for repair, even in the aged, may be so intensified and stimulated to action that renovation of the entire organism may not be impracticable. This, in brief, is the direction which the nascent hope has taken.

In one sense the present investigation of the intimate causes of old age and organic death, with a view to the indefinite prolongation of life, is but a modern echo of a question raised far adown the valleys of antiquity, which the present quarter of a century takes up and repeats, not more faintly and indistinctly, however, but with added voice and more intelligible utterance.

In the light of modern histology and the general biological progress of the past few decades, the problem has assumed realistic proportions. Instead of a hardy query of outlaw aspect, it is seen to be the coming question for science to solve.

As a rule, we find that the Greek and Roman philosophers were not bold enough to raise the question seriously, although it mingled with their sighs over life departing. The Hebrew seers, particularly the apocryphal writers, were more hopeful, as seen in the oft-quoted passage from the "Wisdom of Solomon": "God created man to be immortal and made him to be an image of his own eternity." Also: "The spirit when it is gone forth returneth not; neither the soul received up cometh again." But, "To be allied unto wisdom is immortality."

The ideas of the ancient Egyptians touching life and death are still largely unintelligible to us; no interpretation as yet put upon them has brought them fairly within our realization or sympathy.

Toward the close of the Middle Ages, a fantastic alchemy was embodied in many picturesque projects for prolonging and perpetuating human life.

Near the end of the eighteenth century Dr. Christopher Hufeland, of Jena, put forth his famous book, which in the English translation bears the title of "The Art of Prolonging Life." This, however, is a conservative treatise on the husbandry and care of life rather than a brochure of discovery. As such it should be a text-book in every university.

In the same general vein, more specific but far less comprehensive of the subject, is Dr. John Gardner's "Longevity," published in London about a quarter of a century ago.

The author of "Patriarchal Longevity," whose pseudonym was "Parallax," more nearly raised the question of greatly extending human life, and, moreover, has stimulated yet another very vigorous writer to continue the inquiry. By far the most important contribution to our literature on this subject, in this century, is that of Dr. C. W. De Lacy Evans in his book, "How to Prolong Life," the first edition of which, we believe, bore the title of "The Cause of Old Age." This work enjoys the distinction of having been more freely cribbed from, without credit, than any other book of our times. It is the work of a professional surgeon, and is of a very practical character; its merits are remarkable, its short-comings equally so.

The grounds taken are that old age and its attendant infirmities are caused by accumulations of "earthy salts" (phosphates, carbonates, silicates, *et al.*) in the tissues of the body; earthy, inanimate material which displaces living matter, and is ingested with food-stuffs. The wasting away of the tissues in aged persons is attributed to the erosive agency of an excess of oxygen. From these positions it follows, naturally, that a prolongation of life may be secured by exclusion of the excess of earthy matter in food, and proper watch and ward over oxygenation.

Although contemporary with the researches of Dr. Lionel Beale, Dr. Evans's treatise practically ignores the cell doctrine of life, and also fails to take that wider view of the subject which the now accepted doctrine of the evolution of life opens.

Earthy salts are found in excess in aged tissues; of this fact there is no question; but are they the cause of the aged condition, or a concomitant of that condition? We feel that we have now good reason to assert that the initial cause is something more esoteric than cumulative deposits.

Similar criticism must be made of several very readable popular papers on this subject published in our own country during the last ten years, by Dr. William Hammond. The ancestry, semi-autonomy, and growth displacements of the constituent cells of the tissues are quite left out of the account.

Dr. Beale's "formed matter" will probably be found a more important object of study in aging organisms than Dr. Evans's "earthy salts." "How to Prolong Life," however, has the merit of placing a certain condition of the organism, in old age, in a new and very suggestive light.

But death is not an evil, many thoughtful persons rejoin to our question, or if an evil, it is at least a necessary one. What greater calamity could befall humanity, as human society and human civilization are at present established, than to have the passing generation not pass off, but remain on the crowded stage of human life? Even war and the slaughter of thousands is, by not a few political economists, regarded as a beneficial event for relieving the social congestion of over-populated countries. If there were no natural death, starvation, suicide on a national scale, infanticide, or the execution of aged persons would ensue from necessity.

These are views which are fairly pertinent to the question, although, properly administered, the natural resources of the earth are undoubtedly adequate to the sustenance of six billions of inhabitants, without crowding or poverty, in the place of the billion and a half who now dwell on it.

This latter reflection does not meet the objection of over population, however. Nor is it necessary to meet it in the sense of providing field for a vast population, since nature herself has looked out for all this in her plan of vital evolution. The procreative instinct is intensified or diminished in ratio with the duress which human life encounters in the struggle for existence. With the hard-worked and short-lived, children multiply rapidly. Where all the conditions of life are hard and evil, procreation is active.

On the other hand, education, refinement, ease, leisure, and the prospect of a long, happy lifetime redound not to increase of population, but rather to diminution; so markedly, indeed, has this been found to be true, the inference is a fair one, that were enlightened persons, men and women, freed from the fear of death, the cruder pleasures of procreation would be foregone, from choice, for greater and purer joys in a life of a higher type. We may at least reply confidently that those who are able to achieve greatly prolonged life for themselves will not over-populate the earth.

More specifically, death often is not an evil, but a blessing, to the hopelessly diseased, infirm, and decrepit. Death may even be voluntarily and logically sought by the hopeless sufferer. There are grave doubts whether, if nothing better were to be hoped for in the future by humanity than life as the majority of our fellow-creatures hold it at present, grave doubts whether unconsciousness were not better than the burden and pain of their lives.

These phases and negations but prove the converse of the question, however.

The primary instinct of life is to live. Nature, *ab initio*, makes oath that to be is better than not to be; nor have all the consolatory sophistries of creeds, vouched for by alleged "revelations," ever really convinced a human being of normal intellect that he will live on personally conscious, remembering and seeing, after the death and dissolution of his body. Such "faith" may assist a little to mitigate the bitter pang of dying, but never fully reassures; the common sense still perceives the real situation, and cannot, even in its ignorance and weakness, wholly believe the kindly-meant promissory. At best we resign ourselves to lapse from life with a shudder and a sense of awful heart-break, and on the brink of the great darkness shrink back, and, feebly struggling to breathe again, turn our dim eyes to the beautiful light.

Man has literally fought his way upward; he has battled for life and supremacy; first, with the fiercer orders of the carnivora, the cave-bear, the machairodus, then with his fellow-man for political and moral freedom. His last grim foe is Death. "The last enemy that shall be destroyed is death," saith the Book, but as yet —

> "Death reigns. Dust unto dust must go.
> The nations wail of their dread foe.
> The bitter waters of that wormwood star
> Which burns malign, from pole to pole,
> Are to be drunk. Who may console
> Their mortal woe? Outwelling from afar
> The grief of worlds bewails its dying pains,
> A cosmic dirge, moaning it comes, Death reigns."

To all normal, healthy life, death is unquestionably an evil. Nature has nothing in common with those theorists who, making a virtue of temporal misfortune, seek to persuade man that death is a blessing. Scant must be their souls. Man has developed to live, not to die. Time and space given, man is omnipotent; and immortal life is the dream of the ages.

How much of literature is a dirge, a cry of mortal anguish for friends departed, for self departing from the joys of life! Dread of death is the spur which will drive men to the achievement of prolonged life.

Over all the past and the present hangs a pall, shot only by the bright, intuitive hope that death is not a final law. With the Romans, *Mors* was a goddess in black robes, with ravenous teeth, hovering on sable wings over the whole theatre of life, darting hither and thither, snatching its prey. The imagery comports with the Roman character.

With the Greeks *Thanatos* was a god, whose reign men mourn, whose mission is to nip the joy of life and blast the well-springs of hope. At his approach they shrank and cried, "Eheu! Eheu!" The conception is characteristic of beauty-loving Hellas. Her children ever shrank from that cold, dark realm where there was no sun. The despairing cry of Electra utters the Hellenic sentiment touching death. Burdened as was their faith with the tenets of Egypt, death was still to them the end of pleasure, the tomb of joy. The Greek poets sometimes symbolized Death and Sleep as brothers, twin boys, lying asleep in the arms of their mother, Night; and again Death as a winged boy with sad, white brow and inverted torch; at his feet a butterfly. These last were poetic fancies rather than popular conceptions.

The Hebraic portraiture of death was a solemn and august angel, flying forth from God, armed with a sharp sword to slay the children of men who had sinned. Hence, the strange description of death in the Apocalypse.

To the Hindu, Death was personified by the soul of Yarma (Adam), the first man who died (according to their tradition) and who thus became the monarch of the dead.

Our old Norse ancestors thought of death as a cold, misty presence, rolling darkly on, like the whirlwind storms of their own northland, wintrily enveloping its victims and sweeping them away, enwrapped and lost from sight forever. With them, death was associated with the bleak elemental forces of the air, the sea, and the night, caught in the strife of which they so often perished.

In our times and in all time the vulgar imagery of death is a skeleton. Death makes a skeleton of man, hence man makes death a skeleton. In such grisly representation he foresees his fate.

It was reserved for the grandeur-loving genius of Milton to draw death at once awful and truculent: —

> "The shape,
> If shape it might be call'd that shape had none
> Distinguishable in member, joint, or limb;
> Or substance might be call'd that shadow seem'd
> For each seem'd either; black it stood as Night,
> Fierce as ten Furies, terrible as Hell,
> And shook a dreadful dart; what seem'd his head
> The likeness of a kingly crown had on."

It is a curious fact that death, which is a nonentity, has always been typified by substantive imagery. In a word, the utter absence of energy, or force, has been idealized as a monster of the most forceful character. Fancy has run away with fact. Death is *nothing* in itself, the synonym of nothingness, and has never been better defined than as the absence of life. Matter is apparently indestructible, and inherently endowed with that which may become sentient. The human intellect, with these elements of immortality within its grasp, shudders, and sighs to cease. When the real situation shall become evident to human vision, a new era of mental activity will dawn. No longer vainly praying for miraculous redemption, man will arise to work out his own salvation, and labor for an immortality which will have no uncertain hold on his faith. Then will be exhibited mental activity of which we now discern but transient gleams. The task is mighty; but a grand idea never yet perished for want of soldiers. Man, at least, has this record for his encouragement. Men would not be worthy of immortal life, would not be fit for it, if they cannot achieve it for themselves. Whenever in the past man has risen superior either to brute beasts or brute passions, it has been by his own unaided exertions. However piously he may have prayed and trusted, the fight has always been his own. Overmatched, the good and the bad have always been crushed alike. "God" is not on the hither side of matter. What is on its far side we know not. Yet Right, in the long run, appears to be a better soldier than Wrong. We may, if we please, fancy that "God" made it so, and, having done that, retired to Olympus.

But the Thomases say, "If during two thousand years the average of human life has not been raised more than thirteen years, at most, what hope is there of greatly prolonging life in ages to come?"

The reply is that the outlook cannot be correctly estimated by this past slow gain on death. Through what unwritten ages did man wander a wretched, *fireless* troglodyte, a feeder on acorns and berries, yet in one brief moment the first spark of fire was struck,—fire which made him the rich owner of all the metals, which opened a new realm of comfort, warmth, and food, and spread the race over vast regions hitherto uninhabitable. In that single moment man rose to a higher plane of existence.

Again, primitive man knew nothing of the medical alleviation of disease and postponement of death; but within a single lifetime Æsculapius founded medicine and was raising his fellows from the brink of the grave.

Within historic times, but four centuries ago, human progress was vastly accelerated by a single discovery, which was little more than a lucky accident. Up to the times of Gutenberg what progress had been made for three thousand years in the art of book-making? Till then, books had been laboriously copied with stile and pen, and, so far as any one could then have foreseen, bade fair always to be thus tediously reproduced. A copy of the Scriptures cost from two to three thousand dollars, equivalent to six or nine thousands in this century; but a single decade saw the art of printing born.

Dogmatic unbelief may be as greatly mistaken as dogmatic faith. We assert again that the times are ripe for great discoveries touching life and its co-relative modes of energy. The epoch—and it will be the grandest of human epochs—when the protoplasmic molecule shall render up its secret to human scrutiny is near at hand. Man will then be no longer the abject serf of death, but a belligerent contending for his freedom, with the prize of unlimited life before his eyes.

# THE FREEDOM OF THE UNIVERSE.

*Reprinted, by request, from the previous number.*

"THE point to be particularly emphasized, the truth without recognition of which no correct or adequate conception of a human life can be formed, is that the *root of personality* is in the cell. In the cell a certain *circle* of sentience — the elemental sentience of particles — is formed, the *axis of which is self*, self-consciousness, personality. In the brain many thousand cells are joined by filaments of living matter in such sentient union that they all blend together in a personal one, or *ego;* but the root and origin of it all is in the personal self of the cell.

"When this fact is lost sight of, or given less than its full recognition, the true conception of the human intellect is vitiated and goes astray. The cell is ever what the individual citizen is to the nation, — the essential living unit.

"From this fact, which may be ranked as the first principle of psychology, we pass to the second, also of primary significance.

"A unicellular creature, or a cell of a pluricellular animal, exhibits self, or personality, in proportion to the quality, age, health, and general well-being of the *modicum* of living matter contained therein. In other words, the strength of self, or personality, depends on the health and activity of the protoplasm of the cell. Self-consciousness slackens in vividness and power as the living matter of the cell deteriorates, becomes restricted by 'formed matter,' or starved for lack of food particles. Whatever agency, indeed, depresses the protoplasmic activity of the cell, diminishes self-hood at its axial origin in exact proportion. This self-hood is the origin of individual life. Life slackens as the personality slackens; and death is but the total cessation of self-hood. A cell lives only as it utters self.

"In young, full, normal health its personality is strong. In disease and that consummation of noxious and restrictive agencies which we term 'old age,' personality is weak, and weakens to its cessation. Self, or personality, always resists all agencies which tend to weaken or end it.

"It is as if the component, elementally sentient particles formed a certain pyrrhic circle, or sphere, about the cell's axis, and that the subjective self or personality arose from it. Whatever breaks this pyrrhic union of the particles breaks self, destroys personality. Self appears from the concatenation of life-abounding particles, as the iris shines from the lighted rain-drops, and ceases when sunshine and rain-drops cease to interact; and hence certain of our modern philosophers have been led to regard self and personality as an incident merely of cell life. But this is a partial view, leading to grave error. The cell never really becomes a cell till subjective self reacts in it, by the, as yet, little-demonstrated steps of will-power. Otherwise, there would be no *free will* in the world, and an insentient fatalism would prevail throughout the universe. But one intelligent glance down the tube of the microscope at the humblest little bacterium will show that his subjective self is in reaction there on the external world; in a word, that he is *self-controlled.* A cell is a self. A unicellular creature is a single self. A pluricellular creature is an *e pluribus unum* of cell selves, so connected by living bonds of the self-same protoplasm that they can express all their selves as one. None the less, the seat of all self-consciousness, feeling, pleasure, and pain is in the cell, and there inheres and remains, not only in unicellular creatures, but in pluricellular quite as fixedly.

"Hence it is for the cells that our solicitude should extend. Our care must be for these. Self and subjectivity reside there, and there only; and life is strong only as self is vividly exhibited.

"These are biological facts, and their bearing on the present question is apparent.

"The philosophy which counsels resignation to death, the sinking of self in humanity, the merging of personality in the life of the race, is a philosophy of self-obliteration, a doctrine of death. The reception of such ideas and their adoption into daily thought and practice cannot be otherwise than obstructive to human life. The passivity and apathy of certain Oriental peoples are, in part, due to the long prevalence of similar doctrines. The progress and *élan* of Western peoples comes measurably from the prominent exhibition of self and the culture of personality in individual men.

"Remarkable men the world over have always displayed strong self and even aggressive personality. Self (not a futile "selfishness") is to be cultivated in every human being, and humanity will never be strong till it is composed of personally strong men and women, not resigned to die and sink their souls in an abstraction, but determined to live and secure for themselves omnipotence and immortality.

"For what is humanity, this humanity in which we are advised to sink our personality and merge our souls? This humanity which 'wants above all things its personal *ego* immortality, and holds all else in second rank'? What is it but a million or a billion of personalities? Will any one be so obtuse as to define humanity as the ova, or germs, by means of which one personality now makes shift to bring another into existence? Will any one hold that we ought in moral obligation to stop living, in order that these little make-shifts of life may continue to come into existence *per se?* Is not the race life a herd of individual lives? Does it suffer or take pleasure otherwise than in these individual lives?

"It is the welfare of the individual which is to be considered, not humanity or the race; for humanity, otherwise than as individuals, is an abstraction. When we speak of working for the race and of self-sacrifice for humanity's sake, we mean for the sake of a certain number of individuals. Heredity, inherited excellences, transmitted traits are of no value till they appear in individuals. It is not the germ-plasm of mankind that constitutes the *raison d'être* of life, but the adult man and woman. It should be our care to save persons, not germs. Germs are of consequence only because adults cannot yet be preserved.

"The school of scientific philosophy that accepts death as a finality of personal life neither grasps the real significance of evolution, nor has any true conception of the promise in terrestrial life. Even the best of our scientific men seem to experience great difficulty in shaking off the idea that human beings must *always die* because, forsooth, they have died thus far. But the dream of all the ages of mankind is immortal life, not for the race, but for the individual. The existent faith in disembodied soul life after bodily death is but the mirage of souls thirsty for deathless life; a fantasy, but a glorions one, — one in keeping with the spirit and genius of humanity and one that will never be given up till science has something better to offer men that the certainty of personal death.

"But it has something better. A new conception of the mission of science is entering the minds of men. We shall not always die. Personality, with its treasures of experience, memory, soul, will not always be lost after a few years of inexperience and unsuccessful struggle to live.

"The defect, the condemning defect, of this late school of philosophers, is their failure to grasp the real significance of the evolution of human life. *Death* forms a part of their scheme. They see in evolution only the nether segment of evolution; its grand arc which spans the heavens, its promise of deathlessness to living beings, is still unseen. They bring from their biological studies no tidings to men but the certainty of personal death, and ask them to find their immortality in the germ-plasm. Their creed is a half truth, the dark half. Such a half truth is as futile as error, and may be even more pernicious.

"Life and death are intrinsically antagonistic. Resignation to personal death there should never be in the sense of acquiescence from principle. When death is seen to be unavoidable by any exercise of our powers to escape, it is befitting that a decent calmness and fortitude should be summoned to meet it. But never resignation. Day or night we should cease not to lament that we must still die on account of the imperfection of our resources and the crude state of our sciences.

"Man has developed to live, not to die; and that is a vain philosophy that builds on death, and a false religion that raises a shrine to it.

"Life, longer life, and still more life should be the hope and the faith of humanity.

"Our sciences will bring prolonged life. There is in man, moreover, a tissue, the intellectual tissue, which is still progressive in the sense of evolving a new type; a tissue which will develop deathless life. Die we of the present century may and probably shall. We are still too ignorant to attain prolonged life. But there should be no mistake in our mental attitude regarding death. It is ever an untimely fate, the penalty of still imperfect powers, and an evil to be retrieved with all our powers; and even this radical change in our mental attitude touching death will effect much to intensify and prolong life. In fact, it is the first step toward more life.

"One of the most noxious of popular doctrines is that which portrays the human race as having already reached the acme of possible earthly life — as being the best that can be done on the earth in the line of vital evolution. Whereas all the probabilities are that mankind is one of the incipient developments of that evolution. Human beings die on account of the still unreclaimed, unsubjugated conditions of the earth's surface as a ***habitat*** — not that death is a necessary sequence to life.

"The plain truth of the matter appears to be that we do not personally survive death because we are not yet fit to survive. We are not yet worthy of the immortal life, or the prolonged life which we crave. We are still too imperfect for it, intellectually as well as organicly. Judged by Nature's standard our souls are not yet worth preservation. It is quite as certain, too, that we shall live longer — even become practically immortal — as soon as by earnest research, self effort and endeavor to improve ourselves and our conditions, we have become worthy of it. The universe with all its unlimited opportunities and treasures is before us — to conquer, to possess, to enjoy. Nature neither frowns untowardly, nor yet gratuitously assists us, but yields to our labors with a certain grand, calm passivity, and seems never to grudge us our well-earned conquests. It is ours to take and hold. Otherwise, Nature is not providential. The wall falls and crushes us, if we do not take care. The fire which we have kindled consumes us, if we do not guard it. There is no favoritism. With a wide but impartial smile, the great unconscious Objective would seem to say, 'Go on if you desire. I neither let, nor hinder.'

"To deify Nature and look for 'providential' care from her, is to do Nature an injustice. The vast domain of inorganic matter about us is but elementally sentient, neither beneficent nor malevolent. It is a free and an open field in which we must stand or fall for ourselves.

"These, indeed, may not be tidings with which to flatter and allure the multitude. At such a disadvantage stands scientific truth against ecclesiasticism and its gilded promissory. Yet there are many who see in this aspect of nature and this wide free field for self-development the earnest of loftier ideals, purer morals, and a grander day for man.

"Is it possible to save the soul?

"There have been a great many theories of soul salvation. Every religious system treats of the problem — usually by the summoning in of supernatural powers and agencies, with rite and ritual. The point of chief interest in all these promulgated systems of salvation, the really significant point, is the evidence afforded of the very strong hope and desire of humanity everywhere for prolonged life and immortality. With all their vagaries the systems are so many evidences of the strong desire of human beings for prolonged life.

"Of how great avail these systems (embodying as they always do the slowly developing ethics of the race) have been for the encouragement and comfort of mankind through the darker, semi-brutal eras of race life, it would be difficult to make a correct estimate; such aid, indeed, can scarcely be overestimated. And although in the stronger, clearer light of later science, the tenets of all olden creeds touching disembodied soul life are seen to be invalidated, the hope of deathless life which found expression in them has been fostered and transmitted from generation to generation.

" Never stronger has been that desire and that hope of immortality than to-day when the race, or at least the civilized and educated branch of it, emerging from its childhood into adolescence, casts myth and ditty away and perceives the tale of disembodied souls to be a fable of its infancy, a soothing tale to pacify its early woes.

" In this century we recognize for the first time our real position as inhabitants of a globe in space. For the first time the grandeur and the awe of our situation presents itself as fact and truth, stripped of fable and myth. The mighty opportunities, which the conquest and control of the cosmic forces offer, begin to be perceived. Power, unlimited power, lies idly pulsating in semi-sentient macro-volts. Man has but to subjugate and direct it, to be the architect of worlds even, to restore aged globes, to replenish the vast fires of failing suns. There is neither let nor hindrance in cosmos. No jealous deity tyrannizes; no malignant fiend thwarts. We are alone. Alone on the grand illimitable. Solitary, but free. It is not very probable that the earth's companion globes of this solar system are the *habitat* of intelligent life. What lives on or around other, outer suns we know not; but within a radius of forty trillions of miles, we are beyond much doubt alone. But children no longer, we see ourselves alone and are not afraid. It is a glorious heritage of freedom. We have but to discover, invent, and rule all this cosmic plenitude of empire. To address prayers to the wide, little-conscious *terraine* and sit passive to see them answered in our behalf is idle. The truer conception of universal beneficence makes us sure, too, that such shelter would not be best. We are the unaided free. If we want prolonged life, we must make shift to achieve it. We shall die till we do achieve it; and were we to die resignedly — as our philosophers would advise us — resignedly forever, nature would still smile in eternal calm. Our fate and fortunes import not to *it*. On the other hand, we are under no obligation to *it*. It is ours to win, to hold, and to use.

" The one element lacking to realize all this wealth of freedom is *time*. There is not time. Before we have fairly learned the rudiments of life, we suffer from disease and infirmity, and alas, must die, miserably die, with all this infinite opportunity to live unentered, unenjoyed, unpossessed. Death keeps humanity down to a bootless learning and relearning, over and over, of the mere alphabet and accidence of life. On account of death the human generations scarcely more than hold their own; for in dying the results of teaching are almost wholly lost; the succeeding generation scarcely more than learns what its parents have learned. Little, indeed, of experience is really conserved; for the tissue of intellect must mature for forty years to become really wise. Death causes all this vast labor to be done over and over again, perhaps, on the whole, better, often worse. Reproduction is better than extinction, but only a degree better, and not for a moment to be compared with the grand advantages of living on free from personal death.

"Reproduction takes place because we should otherwise die, but it is not an ideal mode of survival. The individual with his acquired experience and refinement is the ideal survivor. Infancy suffers what would be needless tortures in learning to live, if the adult could survive in health, with living matter fresh, growing, and unshrunken.

"The world-wide demand of educated, inventive man is now for more time. He sees the doctrine of disembodied souls to be a myth, and asks: *Is it possible to save the soul?* Salvation, in the old sacerdotal sense, is the portrayal of an aspiration only; but can we not achieve prolonged life? The question is one that enters with the newer conception of our freedom in the universe. What we have we must achieve for ourselves. We are alone here with everything to gain from invention, research, and discovery.

"Immortality is the birthright of life and the destiny of man. Men still die, but death is not an irremediable evil. The great scheme of life, when grasped in its entirety, points to a purified earth, inhabited by one great nationality, the descendants of mankind, whose lives will be prolonged toward immortality. A *gens* terrestrial and celestial, not over-peopling the earth, nor yet devoid of procreative power; not an assemblage of infirm, aged organisms, kept alive by improved medicaments; but persons fresh in unfading youth to whom aging will bring not infirmity but stronger personality, fuller life, grander beauty, and greater wisdom.

"In protoplasm, or the bio-physical state of matter, in which alone terrestrial life exists, and from which the evolution of life has taken place, there appears to be the demonstration of a great truth of nature, namely, that motion emanates outward from a sentient subjective impulse deep at the heart, the core, of matter; that all natural phenomena have a subjective source, primarily, albeit there are many intermediate correlations of that subjective impulse, ere what we first perceive as subjective takes on the aspect of objective.

"In a word, matter is not primarily *dead*, but subjective and sentient; and our proposition concerning it makes to the effect that a lowly, primitive sentience antedates movement, and is the primary cause of motion; and that in protoplasm, this sentience assumes the guidance of chemism and mechanical motion. Sentience is the subjective side, or component, of universal matter; and matter when aggregated and combined in the protoplasmic state becomes living, that is to say, self-actuating, matter, by virtue of its sentient property.

"Such at least appears to be the more rational hypothesis of life, to wit, that it is correlated and identical with that power or energy in nature of which we do know something, rather than that it is a sporadic manifestation of a new and supposititious power of which we know nothing. For ultimately the question brings us to this alternative.

"Theoretically, matter, meaning ultimate matter, might be defined as that remote, inner centre, or focus, of existence, whence our twin perceptions of energy and of inertia emerge. It is now probable that there is no such thing as inert or lifeless matter; nor yet any such condition of energy as pure force, existing apart from matter. Were we bold enough to attempt a definition of matter in a single word, that word would be *Emanance.*

"And why not Deity?

"Because, it seems to me, that every right-minded person must shrink from ascribing the "wide, sad tragedy" of life, as enacted and suffered in its past and even in its present course of evolution on the earth, to the providence of an omnipotent, merciful, and all-wise Creator, believing such a conception to be immoral. For it is only a purblind optimism that can see mercy, wisdom, or justice throughout the long eras of injustice, cruelty, and bloodshed of which earth has been the theatre ever since life first stirred upon its surface. We would ascribe the responsibility for it to no Being who was able to prevent or alleviate it, but believe rather that Deity is an ideal of the human intellect, and that it will be attained as a result of evolution on the earth, in the apotheosis of man.

"In protoplasm the living substance has slowly *felt* its way, so as to speak, upward by organic steps, from simple sentience to organized intelligence. Sentience, expressing itself in terms of life, has persisted, as if from some inherent stress or impulse, to obtain, through organism, better and fuller development. That stress, that impulse, comes from the nascent perception of joy when sentience first stirs matter, in protoplasm. The lowliest polyp will make a grand struggle to save its life. Nature thus makes oath in every creature that life is indeed a boon and worth the living. In mankind the desire for extended life has grown into an aspiration for immortal life; and in all the great religious systems this aspiration has been projected forward as creed in the immortality of the soul. Immortal life in 'heaven' has been 'promised' as the incentive to and the reward for correct living. Immortal life, or, strictly speaking, more life, has been the ideal of the human era. 'Salvation' from death and misery has been the dream of our race since very early times; the one bright hope never quite despaired of. But, like all the great instinctive aspirations of mankind, this one, in religious systems, has been adapted to man's condition of helplessness and weakness. The aspiration has been given a form of certainty to make it more effective.

"At length, after centuries of dogma, erratic faith, and equally erratic doubt, we are in possession of facts from which a creed may be rationally forecast. Those facts demonstrate the continuous evolution of life under nature from lowliest forms to man; a long, weary and unaided struggle upward through organization from the elemental sentience of matter to the human intellect. But is all this grand effort to terminate in the semi-brutal, half-developed creature, man, with all his ideals unrealized? Has evolution ceased? On the contrary, it is the writer's faith that we have as yet seen but the nether limb of evolution. Its grand complement has still to be disclosed in the perfecting of the human organism and the removal of the causes of disease, old-aging, and death; in a word, the achievement of immortality. Immortal life will be won by applied knowledge. Man will save his own soul. Earth is to be made 'heaven.' 'Salvation' is to come from knowledge and the apotheosis of the race. This is what evolution means. This is what life on the earth is struggling upward to win: Immortality, Happiness, Heaven; ideals to be realized by human effort. The tenets of all the great religious systems foreshadow it. It is time to understand this. It is time to realize our true situation on the earth, and cease from chasing mirage. We have now sufficient knowledge to begin to save our own souls. As well face the facts of our mortal condition to-day as spend another thousand years doting on fond illusions. If we would live, we must save ourselves. This is the religion of life: the religion of self-salvation. It is not 'atheism'; not 'materialism,' in the old crass sense. Not 'infidelity'; rather Fidelity to the best and the essential doctrines of all religions. Not 'scepticism,' but Hope and Faith in Life. Not the 'idle, new dream' of 'Scientific Materialism,' but the Dream of all the Ages; the grand scheme of Nature, maturing and going into effect since first our earth became the theatre of life."

# IN RESPONSE TO MANY QUESTIONS.

SINCE many still make inquiry, it may be proper to outline again the grounds of our present line of research.

Briefly, these grounds are, —

1. The now generally accepted scientific doctrines of the evolution of life on the earth, and the development of the human species from lower orders of living things.
2. The sentient hypothesis of matter.
3. The sentient constant of matter considered as the basis of immortal life, potential.
4. That larger, later conception of the cosmic liberty of life; its liberty to develop and become whatever it can or will or wishes to be, subject only to the laws or moods and movements of matter; that grand untrammeled liberty of the universe where no jealous Deity tyrannizes.
5. The progressive Paradisation of the earth.
6. The prolongation of human life by applied science, looking ultimately to the achievement of immortal life, the realization of that grand dream of all the human ages.
7. The assumption that such realization, such achievement, is what the instinctive human hope of immortality and heaven has all along signified and pointed to; that immortal life and heaven are to be the great complement and outcome of the evolution of life on the earth; and that sufficient progress in biological science has already been made to now resolutely cast aside the fable of supernaturalism and grapple with these more real problems of our earthly existence, as part and parcel of that grander evolution to which our posterity may attain.

# AN ENTHUSIAST IN TRANSIT.

## LABORATORY STORIES. 1896.

It is one of the embarrassments as well as one of the diversions of life at a laboratory for investigating the causes which shorten life, with a view to prolonging our years, that the place becomes a Mecca for cranks (the inventive not the criminal variety), enthusiasts and men of grand ideas. Like attracts like, it is said; — and there are those who deem our laboratory enterprise the quintessence of crankiness.

" In the sight of Heaven all men are equal," we are informed; and if this be true, "Heaven" may not discriminate between the crank, the enthusiast and the man of grand ideas, for all three are of the same genus and differ only in head-piece. Nature makes a distinction, however.

But that is our present difficulty with "Heaven" and "God," as contrasted with evolution and nature; the one scheme is hind side before to the other and becomes more so every day. " God " and evolution are like two inverse ratios, side by side, which diverge faster and farther on either hand, as the fog of our ignorance lifts.

I have little hesitation in classing the subject of this sketch as a typical American enthusiast; and we have to thank " Heaven," or nature, that this class of men is a large one among us; we owe them much. For be this said of enthusiasts and cranks: they are the liveliest, brightest, most lovable persons in the world. Some of them, it is true, are quite wild in their theories; some are laughable; some, in fact, are precious near being lunatics. The majority, however, are merely a little peculiar, from disproportionate mental endowments. It is often a matter of hobbies. Yet some are distinctly tangential. Some are on moderately safe parabolas; others, alas, on hyperbolas, and will ultimately be lost forever in their own immensity of ideas.

But with all their eccentricities, they are exceedingly interesting and often profitable for acquaintanceship. The atmosphere they bring along with them is cheery and inspiriting. They are all persons of hope and faith. They believe that something *can be done.* They never grunt pessimism which is but another name for a disordered body or mind. As a class and altogether they afford a vivid though *bizarre* picture of that restless American inventiveness which marks this great formative epoch of the world's progress.

Moreover, they are the most unselfish persons in the world; in fact, they are never thinking of themselves at all, and hence are often robbed of their inventions by commercial Bashi-Bazooks; and the very sweetness of temper with which they endure these outrages is proof that they are not of this world, but of a better.

Sometimes, as I listen to their ardor and look into their clear, sincere eyes, I half believe that they are "inspired." Inspired they undoubtedly are, right from the great warm heart of Pan-humanity. I have never known one of them that could not be trusted implicitly, or that ever seemed to have a thought of guile or deception in his heart. It is all along of their self-forgetfulness and the touch of star-fire in their souls. It is their faith in humanity, the out-welling of an exuberant altruism which has never yet thought of thus classifying itself.

Considered as people to meet, they are a thousand times to be preferred to the Pooh-bahs, the men of fixed ideas *et hoc genus omne,* in which stupidity and the utter lack of ideas so often pose as a superior conservatism. Contrasted with this latter dull throng, let me live and die with cranks, enthusiasts, and men of grand ideas. They are the *lux mundi.*

The '87 Graduate had been making a summary of the differences between old and adolescent muscle cells that day, and, well pleased with his results, was in an exceptionally good humor, as we talked before the laboratory fireplace that night. It is on such occasions that he holds forth to us on the "Grasshopper theory of Humanity"; and if I remember aright, he was generalizing as to the estimation in which human beings are probably held by the inhabitants of other worlds in space, when we heard a Voice at the outer door, making inquiries of our chore boy. It was a Voice *sui generis.* The Neophyte dropped his much-elevated heels from the jamb of the fireplace.

"'T is one of the 'inspired'!" he exclaimed. "Now keep quiet, all of you, and let me play him."

No flavor of impiety attaches to the Neophyte's use of the word "inspired"; in his vocabulary it means simply a man pursued by an idea.

When ushered in, the Voice proved to be incarnate; and as the stranger came down the room into the warm firelight, we perceived that he was the usual brown-haired, gray-eyed American, five feet nine, and apparently about thirty years old.

" My name 's Stetson," said he. " There 's no money in me for anybody, yet. I 'm merely a harmless crank."

" We knew it," said the Neophyte, genially. " Sit down, Mr. Stetson, and be one of us. We are all cranks here, and more or less harmless. That basket-bottomed chair, the red one with rockers, is a good sitter. Haul that forward."

Mr. Stetson made himself comfortable and tried once or twice to start himself off on general topics of conversation — flat failures, in spite of the fairly good second we extended him. He was too full of his idea.

" I may as well out with it," he said, " although it sounds precipitate. I 've got an idea. That 's why I 'm here."

" This is rhyme, at least," observed the Neophyte. " How old is your idea? "

" Almost a year," replied our frank visitor.

" That is a good age," said the Neophyte. " They don't degenerate into hobbies under eighteen months."

" And I may as well out with it," the transient went on, " for I want to ask a favor here — not money," he added, seeing that the '87 Graduate shuddered as from the twinge of an old wound; " just a chance to hammer and hack a little."

The '87 Graduate looked relieved.

" What is the Idea? " said the Neophyte.

The transient visitor swelled with the magnitude of it.

" CYCLONE- FIRE- AND LIGHTNING-PROOF DWELLING-HOUSES," said he, with enkindled eye and a joyous, sweeping glance, to mark whether we were capable of appreciating it.

" That is truly a great idea, particularly the first part of it," remarked the Neophyte.

" Is n't it, though! " exclaimed the Transient Enthusiast. " Right in line with your researches for prolonging normal, healthy human life, too! You cannot but feel an interest in it. Let me explain more in detail. Or, excuse me, would you mind? " He drew a crumpled manuscript on brown paper from his overcoat pocket. " I have prepared an article for ***Long Life***, describing my invention. Oh, it 's very brief! " he exclaimed, overhearing a groan from the

Casual Worker. "Just a few paragraphs. May I read them?" and he began with a zest and a confidence in his subject that would have outfitted a Jesuit itinerant of the days of Loyola, —

"'Is it possible to construct a cyclone-proof dwelling-house?'

"This is the question which I have asked numerous engineers and other professed experts.

"'Not unless you can build it as strong as a rock of the same size and height as your house, embedded eight or ten feet in the earth.'

"'Will the lofty, seventeen-story blocks, now constructed in the large cities, withstand cyclonic storms?'

"'Possibly; but only by virtue of their great weight. They are quite likely to be demolished.'

"Such are some of the replies received.

"'As strong as a rock of the same size as the house.'

"It is manifest that no such house is possible with the present style of architecture and present building materials. Wood utterly lacks not only weight but strength. Stone and brick as at present made use of also fail to meet the requirement; and the conclusion at first reached is that such a house is an impossibility. True, a structure with Cyclopean walls and roofed after the manner of a bomb-proof might be constructed; but it would be an unsightly object in the landscape, and no one would wish to live in such a contrivance.

"This, in fact, is the conclusion which has been commonly reached, when the matter has been discussed by architects and others during the last ten years, namely, that a cyclone-proof house is, practically, an impossibility.

"It is not well to conclude too hastily, however, that a house cannot be built 'as strong as a rock,'—when the tensile resources of steel and iron are challenged. Human will, abetted by nineteenth century science, has overcome obstacles equally formidable.

"A tornado-proof house is one of the needs of the great west; and I have thought it worth while to make experiment to show how strong a house can be built, at a cost not very greatly exceeding that of a wooden structure; even although many *soi disant* wise heads declare that nothing of this kind is practicable. For such a house appears to be the only resource in the line of even a degree of security, on the part of twenty or thirty millions of people.

"Experiments with artificially produced eddies in water indicate that the present style of house architecture is one of the worst possible for resisting vortical or cyclonic action; this by reason of the general rectangular contour, projecting ells, eaves, cornices, and gables. Firm hold and immense leverage is offered to the whirling motion. All such projections give *hold* for the twisting power, and heighten the destructive energy of the tornado. It early became evident that this destructive twisting power could be much reduced by getting rid of angles and all other projections, and substituting a generally spherical contour.

" For example, when one applies a wrench to a circular nut, little effect is produced, even by an extreme exertion of energy, but give that nut angles, or other projections, and the twisting force at once finds leverage.

" A square rock, or a square house as strong and heavy as a rock, would be far more likely to be twisted from its foundation by either a whirlpool in water, or a tornado of the atmosphere, than one which does not present angles. Such calculations as can be made from data in hand would show that the effects of the twisting power of water and air, when in exceedingly rapid circular motion of low radius, can be reduced as much as six hundred per cent by the substitution of ovoidal for rectangular outline.

"When we follow the observed facts of cyclonic action, however, it would appear that the destructive violence is due as much to a certain upward, vacuum-like lift, exerted by the aerial maelstrom upon whatever it comes in contact with, as to any other phase of its malign activity. It is not its power to twist and thus collapse buildings only, but a certain upward suction that raises the structure off its foundation. There are instances, however, where this lifting power appears to have been reversed and a downward energy exerted which appeared to crush objects, as if beneath Vulcanian hammer blows.

" The reason for such phenomena is made apparent when we consider the real nature of tornado action. The tremendous energy is lodged, or rather vested for the passing moment, in a certain small volume of air which, whirling on an axis with an estimated velocity of ten miles per minute, is yet ricocheting like a cannon ball over the surface of the country, first bounding *upward* off the earth, then plunging *downward* to impinge upon it again.

" Hence the logic of the situation demands that the house shall be constructed to resist this downward blow, as well as the upward lift of the vortex. Here again the chances of safety are vastly increased by offering an ovoidal contour skyward.

"Steel and iron may be skilfully employed to render a structure of such contour enormously resistant and 'strong as a rock,' stronger indeed; but steel and iron alone in practicable quantities are insufficient to furnish that grand desideratum against cyclonic energy, namely, *weight*. The house must be not only very strong, but very heavy, or the tornado will pick it up bodily and whirl it away.

"From a study of all the conditions and requisites of the case, in the light of such experiments and tests as have been possible, the following plan for a cyclone-proof house is presented.

"Its salient features and characteristics may at first be set forth, briefly, leaving many details to be reverted to afterwards.

"Avoiding all technical terms, such a house may consist of an outer iron shell, or skin, not unlike that of a modern 'cruiser,' but not as thick, riveted to a steel-braced iron frame, over thick walls of mason work which arise from the cellar bottom. That is to say, the masonry walls of the house as high as its eaves, whether one story or two, rise from a depth of six or eight feet in the earth.

"It is designed that the cellar portion of the wall, as high as the surface of the ground, or a foot higher, shall be at least three feet and a half in thickness, stone and cement; but that at the surface, on the outer side, the wall shall present a 'jog' inward of six inches, leaving space for iron rods, fish-plated beneath the bottom stones of the wall, to rise through it, on the outside. To these cellar-wall rods, set three feet apart all around the house, externally, the outer iron frame and *skin* are to be bolted. A house fifty feet by thirty would thus be bolted down to its deep-set, heavy, cellar walls by over fifty, inch-and-a-half iron rods. These rods are the radicles of the iron frame proper; and it is designed that the iron skin of the house shall begin at the jog of the wall, at the surface of the ground, where the cellar rods issue upward through the portion of the wall beneath the surface.

"As the iron frame will have support from the thick masonry wall and from the interior cross walls, it is designed that it shall consist of wrought or rolled iron, four inches in width by half an inch in thickness, bolted to the cellar rods above described, each section or length of which shall span the entire structure (save a part of those at the two ends) and be joined to the corresponding cellar rod on the other side. Also that the separate beams or bands shall be stayed by diagonal sections from the four quarters of the house, and by a longitudinal central section, spanning the building from the centre of the two ends.

"The outer skin or plate-iron covering of the house is to be riveted to the frame, and like the iron skin of a steamship, will present a curved outline to the action of the elements.

"As designed, it is not deemed necessary that the outer iron sheathing shall in any case exceed three sixteenths of an inch in thickness. It is likely, indeed, that two sixteenths will prove sufficient. The iron will be protected from oxidization by the usual paints. It should also be given an inner paint coat at the time of erection, with perhaps a coat of 'mineral wool,' to diminish condensation of moisture on its under side.

"This much premised, we may now revert to the form and contour of the house. Experiments indicate that the form most resistant to cyclonic action would be ovate, *e. g.*, half an egg, when cut in two longitudinally, and set upon the ground on its flat side. But the same experiments also show that this form may be departed from to a considerable extent without very materially reducing the resistant power, so long as rectangular corners are avoided. The outline which we have at length selected as safe may be described as a rectangle with the corners all symmetrically pared.

It is also designed that the outer wall, covered by the iron skin, shall have a certain slant inward as it rises to the eaves, in the proportion of one foot to every ten feet of altitude; or two feet slant to twenty feet altitude, if, for example, the structure has two stories. At the height of eighteen feet the deflection centreward is rapidly increased, corresponding to the eaves of ordinary architecture, the roof presenting the appearance of a flattened dome, rising, for a house fifty by thirty feet, no higher than six feet above the eaves line. The four 'corners' of the house are rounded on a radius of eight feet.

"The slant centreward of the outer walls, however, is designed to be rectified, so far as the walls of the rooms within are concerned, by a corresponding diminution in thickness as this wall ascends; so that the masonry wall, three feet in thickness at the ground, will, at a height of eighteen feet, be reduced to one foot, being perpendicular on the inside.

"The proper method of erection would appear to be to first lay and rear the masonry wall from the cellar bottom, inserting the radical rods (enameled to preserve them from oxidation) in the large-bottom stones, laying the wall about them, as high as the surface where the 'jog' inward is made. Interior foundations of mason work for radial steel braces should next be located. These radial braces, which are designed to render the collapsing of the frame from cyclonic twisting impossible, can, it is believed, be placed, generally, in line of the inner partition walls and hence be conveniently out of sight in the house. After setting the braces, the mason work can recommence, and both the outer and inner partition walls be completed as high as the eaves line, the curved wall at the four quarters being constructed after the manner of arches to resist crushing from without, the apertures for windows and doors being provided for as the work proceeds. The interior partition walls, as also the inner surface of the thick outer wall, should be brick, which can be plastered and calsomined, thus obviating all necessity of laths and other wood-work; nor will the expense for such walls be very materially increased when all is considered.

"With the walls complete to eaves height, and the radial braces included within the partition walls for the most part, the iron frame, consisting of the curved beams or bands above described, can be raised, piece by piece, bolted to the upper ends of the cellar rods and to the outer ends of the radial braces, cross-stayed to each other and united into one continent frame, to which the plate-iron skin can next be riveted. Details of lapping the metal plates, so as to repel the weather, need not here be entered upon.

"Over the top of the masonry walls of the house the iron frame and its covering form a low, ovally flattened roof or dome, which can be supported and rendered capable of sustaining a weight of thousands of tons by steel truss-work, resting on the top of the walls, or even by a system of well-secured steel braces and props, at more trifling cost.

"Such a combination of metal and of masonry in construction has many exceedingly advantageous points to commend it.

"The dampness of masonry walls exposed to rain, mist, and a humid atmosphere, particularly near lakes, rivers, or the sea, is entirely obviated, and the house rendered as dry, internally, as a wooden house. On the other hand, the well-known drawbacks attending residence in a house built wholly of iron are neutralized by the thick masonry. The heating of the iron skin from the sun's rays passes unnoticed, as also the unpleasant conduction of sound and the tendency to condensation of moisture where the warm air of a household interior comes directly in contact with an iron roof."

"That is immense!" interrupted the Neophyte; "but where does the *Fire* and *Lightning* part come in?"

"I was just coming to that!" cried the Transient Enthusiast. "Excuse me. A few sentences more only. Not three minutes more, I promise you."

The '87 Graduate sank back in his chair, with symptoms of numb-tongue; but the Neophyte had grown interested, and the Transient Enthusiast resumed his manuscript.

"At present date, the American dwelling-house is a more or less comfortable, often showy, but makeshifty structure; and, save in cities, the building material is commonly wood, as follows naturally in a new country, much of which, when first entered, was covered with forest. Pioneers and first settlers have not the means as a rule to build otherwise than with the material that comes easiest to hand. The style of architecture is in some degree from Old World and even classic standards, but is also in a degree peculiar to the country and to the material, and is as yet of no well-determined character.

"The disadvantages and dangers of wood as a building material are well known, and have been frequently pointed out during the last quarter of a century. Its cheapness and the ease with which it can be manufactured and handled have hitherto recommended it to the temporary poverty of the people.

"Americans are so habituated to the fire-fear, and bear it so constantly in their minds, that they are after a manner reconciled to it. Yet let the slightest odor of pine smoke be wafted to the householder's nostrils, sleeping or awake, and he leaps to his feet with terror in his eye, and the startled thought, 'My all will burn.'

"As one of the results of wood building in the United States, we have a phenomenal development of the business of fire insurance, such as has never been seen previously in any country. It is variously estimated that from eighty to one hundred millions of dollars are required to replace the structures destroyed by fire, annually.

"If a spectator with a wide-ranging eye could mount to a sufficient height to be able to overlook the whole country, he would never, on any day of the year, see less than a hundred dwelling-houses on fire. By night, especially, the glare of consuming homesteads would be continuous. The scene presented to the Tutelar Genius of the nation — if such a genius we have — must indeed be a sad one. The smoke of incendiary fires, 'insurance fires,' fires from carelessness and fires from lightning, rises to heaven constantly and never will cease to rise as long as houses are built of wood. For man is also a fire-making being and daily kindles his culinary blaze inside his combustible house. The marvel is not that there are so many fires, but by what grace and mercy of our household gods there are so few!

" Later generations will probably read of this age of combustible houses with astonishment and wonder that their ancestors survived the fire-traps which they set for themselves.

" For the age of wooden houses now hastens to its close. It will terminate largely in the natural order of things within the next half century. For although an improvident population would no doubt go on building of wood if lumber were cheap, the devastation of the woodlands wrought by lumbermen and the general deforestation of the country incident to rapid growth of population will ere long render lumber expensive and practically unavailable as building material. Already in many sections, indeed, where wood is used, it is no longer cheaper than stone, brick and metal, but is employed for conventional reasons and because wood carpenters and joiners are more conveniently hired than masons and metal workers.

" The wooden house, moreover, is the plaything of the cyclone.

" Throughout the great midland west and northwest, twenty millions of people, during the spring, summer and early autumn months, live in a species of diurnal fear and trembling at the sight of every dark cloud that rises in the sky. Ever present in their minds, tingeing all their pleasures, is this Atra Cura, this Black Spectre of a possible cyclone, lightning-armed and furious, — an aerial Titan gone mad, dealing destruction and ruin on every hand!

" A little less constantly present, but a genuine life-fear none the less, is the apprehension from lightning stroke, which with many persons is a source of seasonal misery and transforms the refreshing grandeur of every summer shower to a phantasmagoria of terror. As nearly as can be gathered from local newspapers and other sources of information, nearly five thousand houses and other buildings were struck by lightning in the United States during the year 1894, and nearly eight hundred persons either killed or seriously injured. The popular fear of lightning is therefore a well-grounded one.

" It cannot be but that this continuous apprehension and anxiety concerning cyclones, fire and lightning stroke act as a vital depressant in the life of the entire population, tending to make human existence less happy and care-free; and that such sources of unhappiness and anxiety tend to shorten life.

"Now it will not have escaped attention that our proposed cyclone-proof house is also a fire-proof house.

"It will be apparent, too, to all possessing even a rudimentary knowledge of electricity, that the iron frame and iron skin, connected by the fifty iron cellar rods with moist earth eight feet below the surface, offer a complete protection to the inmates from lightning — even from the most forceful thunder-bolt which ever fell from the clouds. Such a house may be pronounced absolutely safe from lightning stroke, since the thick masonry between the iron covering and the rooms will act as a non-conductor and completely insulate the occupants. Here the householder may sit down and watch the fury of the black thunder squall with serene mind and a sense of perfect security. The thunder-bolt may fall, but the huge metal shield will conduct it harmlessly into the earth.

"It is the opinion of architects, that a cyclone-proof house of this description need by no means be found lacking in external architectural beauty; and that so far as utility, fitness and strength constitute comeliness, such a house, handsomely painted and ornamented, may be made very attractive, needing only the sanction of 'fashion' to commend it readily to the popular eye.

"Porticos, window awning frames, cupolas, piazzas, balustrades at the apex of the domed roof and around the eaves line, for artistic effects, in iron, or even wood, may be liberally added externally without injury to the stability of the house, even if these light structures were carried away by a tornado.

"Well, gentlemen, that is n't all. I have not described the internal plan. But I will stop here," the Transient Enthusiast broke off reluctantly. He had heard the '87 Graduate yawn. "You can all read my paper when it is published. Now tell me what you think of it."

"'T is a great thing, if you can float it," replied the Neophyte; and we all said so.

"I knew it would strike you!" cried the Transient Enthusiast, with conviction.

"Now, what I want," he resumed, in a less exalted, more matter-of-fact tone, — "what I want is a place and a chance to make my dummy, my model, you know; and I thought perhaps you would give me work room here, tools and things to do with, you know."

Welcome was extended to him.

"No man with an Idea is ever turned away from this place," remarked the Casual Worker.

"There 's work-bench, lathe, anvil, and all the tools you want in the basement. Go ahead and God speed the Idea."

"That 's kind!" cried the Transient Enthusiast. "That 's the sort of men to meet! I 'll abide by any rules, regulations, or requisites that you happen to have here. Are there any?"

"None," replied the Neophyte. "It is necessary merely that a *debutant* here shall be a crank, an enthusiast, or a man with a grand idea; you fill the whole bill, Mr. Stetson."

"Oh, one thing more," the Transient Enthusiast added, apologetically. "I suppose I shall have to sleep and eat once in a while, — but I can sleep anywhere and eat anything," he qualified.

The resources of the place were sufficiently stretched to provide for him, and without further ado he became one of us.

He sojourned with us for five weeks.

He hammered and he pounded.

He hacked and he malahacked.

He made a horrible din.

He never picked up after himself.

He dulled every tool in the workshop and broke not a few.

And every night, after work, he sang peans to us, loud roundelays of hope, joy, and approaching triumph, of which the '87 Graduate nearly died.

Yet we loved him, actually loved the galoot, in spite of the tarantula dance which he led us.

His dummy weighed seven hundred pounds! It required the united strength of us all, with levers, to box it and get it out of doors.

He left for Kansas City with it, May-day morning.

"I shall not write a word to you till I get started," he said.

And he has n't written yet.

His plan was to form a company in Kansas City, Omaha, or St. Louis, and then go about with his model, in the wake of cyclones — wherever he heard of one.

In its present form I believe his idea wholly impracticable. But it is one of those things of which we say, "There may something come out of it."

# THE PRESCIENT DISCOVERER.

## PLASMODIUM SENECTUTIS.

WE knew that he was a man with an idea, or at least strongly suspected it, from the moment he called at the laboratory; the symptoms of such possession were well-marked.

But he proved non-committal, being of a temperament and habit of mind more self-contained and less centrifugal than enthusiasts run. The Neophyte failed to "draw" him; and the Neophyte has grown skilful at this sort of diagnosis. He is making a study of American enthusiasts, and aspires to become an expert in them.

The Prescient Discoverer remained all day with us and disclosed nothing; and at night he departed as if to go his ways for good. Moreover, he was but a youth, fresh from one of the most reputable medical schools of the country, and the interest and appreciation which he evinced in examining certain of our preparations showed that he had been well instructed.

The Neophyte was puzzled. "That fellow has got an idea of some sort aboard," said he, "but he is *cagey*. I think that he came here to crib an idea to inspan with one of his own. It's that, or mere modesty."

It was modesty. The Prescient Discoverer came back next day, and at luncheon he unbosomed himself, with a blush at first, till the Idea began to speak through him; then, indeed, he was as bold as the best of them. For none so brave as the man possessed by a grand idea. It casteth out all fear, and putteth strength into the weakest knee.

But though a little tardy in delivery, his idea was a bouncer when born; had its teeth all cut, so to speak, and had already toddled forward into a theory of human salvation.

"I would like to have you examine a series of slides which I have lately prepared, and which I have brought here to-day," he said to us. "I am confident that I have made a discovery, from the bacteriological side of modern research. I have discovered ***plasmodium senectutis.***"

"What, really? the microbe of old age?" said the '87 Graduate. "Then, indeed, you are the very man whom we want to see here."

"I have discovered a micro-organism within the cells of nearly every tissue of the human body, which I am convinced is of the nature of an intruder, a hostile parasite, a worm in the bud of life. I believe that it is this bacterium, or intrusive plasmodium, which saps or eviscerates the tissue cell and causes that slow and as yet unexplained decline of the organic life which we term old age," the Prescient Discoverer asserted.

"But in the matter of priority, an Italian biologist has already laid claim to such a discovery, also a Frenchman and one or two amateur bacteriologists in America," the Casual Worker observed.

"I have recently heard something of these claims; but my researches have been conducted quite independently of others," replied our visitor, a little disturbed. "I do not even know what these people claim to have found; I only know and have brought here what I have myself found."

"In the cells of what tissues does it occur?" the Neophyte asked.

"In the brain cells and in muscular tissue, in hepatic tissue, and in a few instances I have found them in ordinary connective tissue; and I believe that I can show you two slides where I have demonstrated it in bone cells. It is not infrequently found embedded in leucocytes, and occurs in the true blood corpuscles."

"Your material was taken from aged subjects, I suppose?" observed the Casual Worker.

"All of it, save that on my control slides; those were from adolescent or young-adult cadavers; eight subjects in all," replied the Prescient Discoverer.

"But admitting that you have found what you think you have found, namely, an alien micro-organism, similar to the alleged plasmodium of malaria, within the tissue cells of the human organism, what evidence have you that it produces the phenomena of old-aging?" the '87 Graduate asked. "Do you mean to tell us that you have worked it out in conformity with Koch's laws? Those constitute our present criterion, you know. Before you can legitimately christen this new bacterium as ***plasmodium senectutis,*** it must be shown to exist in aged subjects. It must be propagated in cultures. It must produce old age in subjects inoculated with it."

The Prescient Discoverer laughed.

"Well, naturally, I have not inoculated anybody with either my newly discovered plasmodium, or its virus, or ptomaïnes. And if I had, there would hardly have been time to develop a case of typical old age in the patient," he said.

The Neophyte and the Casual Worker joined in the merriment; but the '87 Graduate stood to his guns.

"Then you had better abrogate your christening of *plasmodium senectutis*, or at least place a conspicuous interrogation point after it," he rejoined.

"That is the bane of scientific research," he continued, "the abuse which most brings discredit on science, — this wild jumping at conclusions, this zealous crowing before day, this premature guessing at facts. It is bad form. It is wholly unscientific. It is positively immoral."

The Prescient Discoverer's feelings seemed to be hurt. He was on the verge of anger.

"What would you have?" he asked. "Please reflect; I have as yet published nothing. I have found a bacillus, and I have come to you, another bacteriologist, to show it to you and confer with you about it. Is this so devilish improper? It seems to me that you are yourself the one who has gone off at half-cock!"

The '87 Graduate came down promptly.

"Very true," said he. "I spoke hastily. I feel warmly on that subject."

"Or a little sensitive, perhaps?" and the Prescient Discoverer raised his eyebrows slightly. "Somebody has 'crowed' in advance of you, perhaps?"

"Perhaps," replied the '87 Graduate humbly.

"But let's see your slides," said the Neophyte, impatient of this irrelevancy. "New bacilli are by no means rare. But a supposed plasmodium of old age is interesting. Did you say that you had made a culture of it? Have you actually propagated colonies from it? What did you use for your nutrient media, gelatine, bouillon or agar-agar, — acid or alkaline?"

"Agar-agar. But I confess that I had bad luck with my cultures. I sterilized carefully, but I had the worst of luck."

"That's nothing. Everybody has such luck till he gains knack from experience; and even then he will have bad luck," remarked the Casual Worker.

"Well and good, but what did you get your 'seed' from — not from the tissues of cadavers, surely?" observed the '87 Graduate.

"Yes, I did. My theory is that this is a spore-producing plasmodium, and that the spores survive for days or weeks or months in cadavers."

The '87 Graduate looked incredulous. "Have you any other theories regarding it?" he asked. "In what manner do you conceive that these spores are constantly transmitted from one generation of human beings to another, from parent to child, I mean?"

"Through the blood," replied the Prescient Discoverer.

"What! the placental blood of the mother, enfiltrated to the embryo or the fœtus?"

"That may even be. But I imagine that all old persons give off these spores by millions in all their excreta, and that we constantly ingest them from early youth upward," replied the Prescient Discoverer. "I imagine that it is as if phthisis were a hundredfold more common than it is. From my point of view, old age is a universal disease. Not only man, but every organized form of life, except perhaps infusoria, has it and always has had it, and died of it, from remote ancestry downward to present time."

The Casual Worker laughed.

"Well," said the '87 Graduate, "don't tell me that you stop there. A man with your wealth of imagination must surely have struck out some means of curing this — this universal disease?"

"It is a physician's business to cure disease," replied the Prescient Discoverer, with an assumption of dignity. "Yes, if my theory of this plasmodium be correct, I hope to cure its ravages. I hope to obtain a culture virus; I hope to inoculate dogs with it and continue the inoculations on a series of dogs, until they are immune. Then, on the same plan which has been successfully pursued with the bacillus of diphtheria in horses, I hope to use the blood serum of the immunized dogs as an anti-toxine for *plasmodium senectutis*. Or, if this method proves impracticable, I shall try other methods of procedure to obtain a remedial agent."

"No one can impeach your motives or intents," replied the '87 Graduate. "I bow to them with all respect. Now let's see your slides."

The Prescient Discoverer undid his grip and produced two slide boxes. "I did not bring a microscope stand," said he; "I knew you must have plenty, and also objectives. I have used a $\frac{1}{12}$ mostly."

The Casual Worker made haste to set his fine new stand under a good north light.

"That's a 'bute'!" cried the Prescient Discoverer, enthusiastically; the vernacular of the undergraduate had not yet wholly left him. "Wish I had such a stand. The working distance of my objective is all too short."

The casual worker attached an Abbé condenser, screwed on a $\frac{1}{80}$ objective, and set cedar oil and xylol handy.

The Prescient Discoverer then selected a slide from box No. 1, labeled "Nerve Tissue." "This shows you plasmodium senectutis in four large and two small pyramidal cells of the human cerebrum," he said. "The tissue is from the cortex cerebri of the superior frontal lobe, right hemisphere. It was hardened thirty days in alcohol and stained very lightly, as you will see, with eosin and hæmatoxylon. The subject was eighty-one years old; sex, female."

As he spoke he put the slide on the stand, applied a drop of cedar oil, focused and looked attentively.

"This is, indeed, a fine instrument," he murmured, with his eye at the eye-piece. "What a light! what amplification! Here must be twenty-eight hundred diameters, and clear as a January morning! And here they are," he continued, moving the slide slightly to and fro. "Here they are, right in the centre of the field to the left of the cell nucleus," and he stood aside for the '87 Graduate to look at them.

The latter has a slow eye, albeit a sure one when it has taken hold. He looked for a full minute by the clock. The Prescient Discoverer evinced impatience. "Well?" he said.

"Your microtome was none too sharp when you cut this section," observed the '87 Graduate at length, without looking up. "You should sharpen the blades with an oiled strap, after honing.

"Your hæmatoxylon solution had been made too long when you stained this section," he went on, still looking. "But you have learned to stain lightly; that's a good point."

"But what do you see in those cells?" exclaimed the Prescient Discoverer.

"Oh, many very interesting objects," replied the '87 Graduate, withdrawing his eyes and going to the window, as if to rest them.

The Casual Worker took his turn at the eye-piece, and then the Neophyte. Both wore a thoughtful expression as they withdrew.

The Prescient Discoverer regarded them with an anxiety verging on indignation, which, however, he would not allow himself to manifest.

"Let's see more of your slides," observed the Neophyte, tentatively.

Without replying, our visitor selected eight others, which he arranged in order on a rack by the microscope; he seemed disconcerted, or doubtful, but proceeded to place the first of the series under the objective. "This one is cortical cerebellar tissue, from the same subject," he said, after focusing. "In the right centre of the field you will see a large Purkinjé cell, in the cytoplasm of which, near the nucleus, one of these same plasmodia is visible. Below, to the left, is a second, and moving the slide slightly to the right, still a third will come into the field. The similarity, I might say the identity, of these plasmodia with those on the first slide will be apparent to you, I think."

We experienced no difficulty whatever in seeing the intracellular objects which he designated; but a sense of estrangement had supervened, which threw gloom over the exhibition.

The next slide was a muscle preparation and the fourth osseous tissue, both from a male subject seventy-nine years of age, we were told. Then followed a slide on which two white blood corpuscles were in the field, in both of which were appearances resembling those above particularized.

"Shall I show you others?" asked the Prescient Discoverer, coldly. The estrangement and the lack of sympathy had now grown quite melancholy.

"Not unless you wish to do so; but I would like to see your cultures from the spores of this plasmodium," replied the '87 Graduate, with a reserve deep as the snows which cover Maine in February.

Self-wrapped and distant, our visitor placed three slides, successively, under amplification. By this time, the estrangement was suspicion on his part.

Dionysius of the Ear was not less bereft of human confidence than is a modern scientist in the presence of a fellow investigator pursuing the same line of research.

The Prescient Discoverer wiped his slides and replaced them. We perceived that he was inwardly cursing himself for rashly bruiting his discoveries, and was perhaps meditating a rapid rush into print, lest some one of us should forestall him. Alas for poor human nature, which pursues fame over seas of piracy, and is something of a buccaneer itself!

"I have come here and shown you my work in a rather boyish way," the Prescient Discoverer observed, frostily. "Of course, I do not ask you to give away your opinions," he continued, after replacing the slide boxes in his bag. "When I came here, however, I had an idea that some such exchange of views might be pleasant. Apparently I was mistaken," he added, still more icily, after a moment's pause.

"No objection whatever to giving you my opinion," said the '87 Graduate, bruskly. "But I do not believe that you want it."

"What is your opinion, then?" said the Prescient Discoverer, defiantly.

For reply the '87 Graduate went to a case which contains his own collection of mounted objects, and fetching a slide, put it in the microscope. "Look at this," said he; "and when you have done so, we will take another look at that slide of yours — the one you showed us first."

The two slides were examined one after the other. "Do you see resemblances?" queried the '87 Graduate, grimly.

The Prescient Discoverer flushed; his hand shook as he changed the slides for a second inspection.

"Now do you want an opinion?" asked the '87 Graduate.

"Give it," replied the Prescient Discoverer, sitting down in a chair and facing us with a face that had grown suddenly wan.

"Well, then, what you call *plasmodium senectutis* in these cerebral cells, from this aged female subject, is nothing more nor less than a rather large, faded pigment granule, such as are not unfrequently found in nerve tissue cells. Their office and effect on the cell life are not well understood, yet there is no reason to suppose that it is anything very formidable."

The Prescient Discoverer rose suddenly, protestingly, to his feet, and again examined the two slides.

"My God! I believe you are right!" he exclaimed, and sat down again.

Only a microscopist can realize what a knock-out blow he had received.

"In these other slides of yours," the '87 Graduate continued, "there are a variety of things which you have ingeniously, though in perfect good faith, picked out and classified together.

On the cerebellar slide your plasmodia are again pale pigment granules in two cases, and a dead nucleus in a third; in the muscle cells they are simply dead nuclei and vacuoles; in the hepatic cells they are really, I think, intrusive bacteria, or else small secondary nuclei, either degenerate or dead; and in these white blood corpuscles there are two encysted bacteria which are not sufficiently well shown to be classified. And finally from your cultures you have three quite common forms of cocci. I hope you are not offended," the '87 Graduate concluded.

"No," replied the Prescient Discoverer, doggedly. "No doubt I ought to thank you."

"You had," said the '87 Graduate, calmly. "We have extricated you from a scrape. We do not profess to know very much here, but in this case we have been able to save you from a serious mistake. If you had published your 'discovery,' you could hardly have recovered in a lifetime from the confusion which it would have brought upon you. Older microscopists than you have fallen into such errors. The tissue cell, as at present prepared for examination, is a great field and contains many curious things; and when an investigator starts off with an already formed theory, as you did to discover ***plasmodium senectutis***, he is quite likely to find it!

"I know exactly how you began your researches, for I once did almost the same thing," the '87 Graduate continued.

"You first read a great deal about the germ theory of disease; and one fine day the idea popped into your head that old age was a slow disease caused by a 'microbe.' Full of enthusiasm, you then set to work to prove that your theory was true. You prepared a great number of slides from the various tissues of many subjects; and it would have been strange, indeed, if from them all you had not found what you were in search of; for, as I said a moment ago, the physiological cell is a very fertile field for discovery! A man is n't safe to go prospecting alone in it, until his imagination is fortified by considerable experience."

"But these other bacteriologists who claim to have found a bacillus of old age — what of them?" demanded the Prescient Discoverer.

"I do not know what they have found," said the '87 Graduate. "Whatever it is, it must require a long time to demonstrate it in accordance with Koch's laws. The fact that any one should so immediately announce the discovery of a 'microbe of old age' appears strange on the face of it. Thirty years would be a short time to demonstrate such a bacillus by Koch's third law."

"At this laboratory then you have found nothing of this description as yet?" questioned the Prescient Discoverer.

"Nothing."

He went away sorrowful, as one who has lost great possessions, or lingered too long at Monte Carlo. The enkindled eye had quenched its inner spark; his step was not as light, his elate mien had turned listless.

Ah, but it is a sad thing to have a beautiful theory come toppling down about one's ears!

## THE BIO-OSCILLATOR.

THERE was hilarity at the laboratory that day, for the Neophyte was trying his 'prentice hand, with the aid of a new Leits microscope, in quest of the bacteria in ordinary vaccine matter, taken from the quills of a well-known producer whose heifers are warranted "perfectly healthy animals."

The Neophyte had found fifteen different kinds of cocci, bacilli, and spirilla, and, so he announced to us, was hard after a sixteenth, when a visitor entered.

Now experience shows that, besides transient callers, two species of visitor come to the laboratory, the person with a grand idea which he burns to unbosom, and the person in search of one to crib.

The observant, gray eye of this caller seemed rather to place him in the second category. He was a man of good personal presence, of cultivated, or at least worldly-wise bearing, and yet a man, as one would have said, with the ghosts of not a few defunct enterprises haunting his face and mien — ghosts which had but sharpened his glance and which drove him onward only the more keenly to new ventures. The inventor's heart-break rarely falls till fifty, and here and there a Keely works on with a westering eye till far past the half-century mark, before the last *icon* is taken down from the pillar of his earthly race.

Otherwise our visitor was a spare, brown-haired, bony man, above middle height, well attired and silk-hatted to date. And the allusion to Keely was suggested by him, I should think; for after presenting a card which bore the name of Thomas C. Thurston, M. D., he preluded with a few introductory and complimentary remarks, and asked a question: —

"Are you familiar with the discoveries of the inventor, Keely?"

"Hardly," I replied. "Is anybody familiar with them, let me ask?"

"No and yes. But I mean that you have of course heard of the 'Keely motor' and the 'etheric liberator'?"

"Heard of them, certainly."

"It is true that but a few persons, comparatively, know how fully in earnest Mr. Keely is, or realize on the verge of what world-revolutionizing discoveries he has arrived. Two public failures of his 'motor,' so called, to do continuously what its inventor hoped it would do have undoubtedly injured his reputation popularly."

"You believe in it, then?" I said, by way of continuing the conversation which I feared did not promise great things.

"Undoubtedly," replied Dr. Thurston. "I should say, indeed, that his invention was already in the list of accomplished facts."

"Meaning the 'etheric liberator,' so called?"

"Yes; it bears that name."

"You have knowledge that it will actually liberate energy, as claimed?"

"I have seen it do so."

"That should be a comforting knowledge to not a few persons."

"Most people forming their opinions from what is printed in newspapers believe that Mr. Keely is an impostor whose business it has been to prey on the pockets of credulous rich men," remarked Dr. Thurston. "The reverse is the fact concerning him. The man is a devotee to his idea of a grand, slowly unfolding truth of nature. And he will triumphantly demonstrate it."

"But what is the latest Keely conception of the ether? How does it now stand to him?" I queried, in continuance.

"Quite like the common scientific conception, that of a rarified medium of matter of exceeding tenuity and perfect elasticity which pervades all space, even the pores of solids and fluids; and also with this in addition to that conception, namely, that this tenuous, elastic medium is not a passive medium, but powerfully charged with energy; that it is in itself the last embodiment of energy; a storage medium for the universal energy which seethes there, so to speak, at a tension of which we have or can acquire but a slight conception; this energy being constantly exhibited in it as a *quiver* of intense vibratory motion."

"And the 'liberator'?"

"Is adjusted to receive and set up vibration, synchronous with those of the ether, and by thus getting 'into beat' with it, is able to take its impulse, or motive power, directly from the ether, or in other words directly from the entire universe, from all nature."

"A truly magnificent theory, which sounds so fine that one would wish to have it true," I remarked. "I have heard it described somewhat differently, however; and in both instances, I have been struck by the resemblance of Keely's etheric liberator to Nicola Tesla's electric oscillator, another theoretical device or machine, nearly perfected, it is said, for deriving unlimited electrical power from the earth's electrical 'charge,' or otherwise getting *en rapport* with the source of all our electricity; and in this case, too, the method is synchronous vibration, or harmonious 'beat,' of the dynamo with the earth's magneto-electric condition. Here would seem to be two investigators who are attempting to tap the same source of power, but by means of somewhat dissimilar devices."

"I was about to speak of the Tesla oscillator," said Dr. Thurston. "It is plain to me that what Tesla describes as the earth's electrical charge is nothing more nor less than the Keely ether, or atomic matter surcharged with energy. Tesla has approached the subject from the standpoint of an electrical engineer, Keely from the less special grounds of a natural philosopher; hence their differences of terminology; but both are in pursuit of the same game, and it is a matter of great curiosity and interest to see what each will develop. In any event, what has been accomplished by these two experimenters appears to me to bear a very suggestive relationship to the theory of elemental life in matter which you seem to make the basis of your researches at this laboratory."

"Possibly; but what relationship?"

"Why, you hold that matter is, at bottom, sentient in low degree; that the ultimate atoms or particles feel and are, in a lowly sense, living particles; and that all living creatures have risen step by step, developed from this primary sentient attribute; in short, that matter first feels, then moves and lives, after a purblind fashion at first in the simpler organisms, afterwards more sentiently and intelligently as the organic structures are improved."

"You have expressed the view held here fairly well," I said.

"If I apprehend the principle correctly," Dr. Thurston continued, "the primary impulse of all energy in nature is *feeling*. Matter moves because it feels. It is not an insentient dead universe, but a *living* one. Life, meaning consciousness and self-consciousness, is the sentient side of the matter contained in the individual organism. It is the natural bio-static condition of matter, risen, by means of complex organization, from low sentience to a high intelligence."

"You are outlining our views very well," I remarked, with some curiosity as to what was to come next.

"Well, then, it seems to me that if Keely can devise a means of obtaining unlimited power from the ether by getting 'in step' or 'in beat' with it, and if Tesla can draw limitless electrical energy from the earth by finding out the 'period' of its vibratory motion, or its electrotonus, and putting his oscillator in beat with it, *there may be a means discovered* of vivifying or revivifying the human organism, of restoring and renewing the flagging life of human beings by getting in beat, in synchronous vibrating harmony, with the bio-static condition of the ether, the earth, the universe, all nature. In the language of Tesla concerning electricity, we may say that by the proper devices we may connect the human organism with the eternal, universal life of Nature and live directly from her."

"That is a very grand conception," said I. "Your idea is to put each human life 'in beat' with the biotonus of the earth, or, to apply Tesla's phrases to life instead of electricity, to make human lives consonant with the vibratory period of the earth's life 'charge.' Is that the idea?"

"Exactly, to a dot!" exclaimed Dr. Thurston.

"May I surmise that you have already made some progress in the way of a practical solution of this problem?" I ventured to ask. "That you have in mind some device in the way of a bio-oscillator, if I may coin such a word?"

The Doctor appeared lost in thought for a moment, then said, suddenly, "I have a lady with me. She is sitting in a carriage outside. May I — is it quite proper — shall I ask her to come in here?"

The Neophyte who was in his shirt-sleeves, made a cane-rush for his coat and plucked at his cuffs. Ladies, alas, are not every-day visitors with us; the scrub-woman comes and goes, but the gayer flowers of her sex find little to attract them here. Two, it is true, have come within a year, gay flowers indeed they were, seeking boldly devices for the renewal of facial bloom; but what we could suggest in this line required both self-restraint and time, and hence did not elicit their gratitude which was keyed for immediate results without pains-taking.

We summoned our smiles and looked for a clean chair with a cushion and rockers, and after an elemental sort of pause Dr. Thurston re-entered, followed by a young lady of truly remarkable physique, whom he introduced, generally, as "My companion, Miss Althea Estes."

As I have spoken of her appearance as somewhat remarkable, I may add that although her general mien was youthful, seemingly that of a girl of twenty, her hair was quite white, luxuriant hair none the less, combed upward and backward from a wide, low forehead. A health-abounding woman, with full red lips, large, clear gray eyes, and a clear-tinted complexion verging to brunette. A strong woman of good height, broad shoulders and the waist of a Hygeia to whom I was minded to compare her from the species of girdle which confined her thick gray wool dress, and the easy grace with which she wore her outer garment, — an astrachan coat, if I recollect aright. She had large, shapely wrists and hands, and wore, as we had occasion later to observe, very beautiful rings in unusual number.

Miss Estes entered, as I have said, and quietly acknowledging our commonplaces, took her station among us as one who thoroughly understood her part. Indeed, she had no more than spoken, in a voice low, but of unusual timbre, than I felt sure that she must have enjoyed the advantages of a histrionic as well as a carefully guided vocal training. She seated herself, as did the rest, save Dr. Thurston who remained standing near the lady's chair at her left hand. He then resumed the previous conversation.

"Now an infant, a child, or any very young person, may be and generally is, I think, much nearer 'in beat' with the life of nature than an old person," he said; "yet bad ancestry acts here and many or the most of infants come into the world 'out of beat' with the earth's life. Then, too, as we grow older and become more selfish, and form 'set' personal habits, we no doubt become more isolated, more out of chord with the bio-static condition of nature. My own idea is that this is why we die of old age. That, in fact, would be my definition of old age, a falling out of synchronous vibration with the earth's life. We live only as we keep 'in beat' with it, and slacken to final cessation as we gradually lose our relationship, our consonance with it.

"Now my companion to-day, Miss Althea Estes," the Doctor continued, with a smile and a polite bow to her (and he never failed in addressing or speaking of her to make use of her full name), "is an admirable instance of this theory. She is in perfect health, in the full prime of womanhood and, as I think, in well-nigh perfect synchronism with nature or with the earth's 'charge' of life, if you please. She appears to be able to take vital impulses from that life charge of nature and to communicate such impulses to others."

The Neophyte whose mental condition is "synchronous" with beauty at sight, attempted at this point to short-circuit a top-lofty compliment, which fell sprawling, however; yet the lady kindly acknowledged it and helped him set it on its legs.

The Doctor went on, however, without noticing the interruption.

"A human life is, physically, a complex series of chemical actions and reactions, accompanied by constant magneto-electric disturbance of its environment, and by a personalization of the sentience of matter. If we were to say that a human life is a bio-magnet which maintains a constant 'field' of energy and influence far and near about it, as long as it lives, we should not have hit on a bad simile. It can hardly be otherwise, therefore, but that one life should influence others about it. Why such influences are not more commonly felt is probably due to the difficulty of establishing a really synchronous, or symbiotic condition, between two organic lives. They are not 'in beat' one with another. It becomes a desideratum, therefore, to bring them into the synchronous relationship."

The Doctor paused to audit criticism, but no one volunteering any, he proceeded to our better comprehension of the object of the visit.

"I have long been a believer in the art of symbiotic healing, and my more recent studies have led me to practise it in a somewhat empirical manner, in the hope of developing my theories into a science, or a system," he continued. "And I can say of these experiments, what an empiric in drugs cannot be so sure of, that my ignorance and my failures have never done any harm, even where they have failed to accomplish cures. I have, therefore, seen nothing wrong or deleterious in such attempts to cure patients by symbiotic agency, and learning as I go on, from such cases; for I have always been too conscientious to dally or experiment in urgent or alarming cases.

"Now in Miss Althea Estes I have found a subject who appears to me to be more nearly symbiotic with nature, or to return to our former borrowed phraseology, more synchronous and consonant with the earth's life, or life-charge, than any person whom I have previously met; and some very pretty and convincing results have at times followed our efforts to relieve suffering by placing the sufferer in chord with nature, through her instrumentality. These effects are so tangible as to be distinctly felt by well persons as well as the sick, as we shall be happy to illustrate to you here at the present time and place, if you can afford to give us a few moments more of your time."

Churls, indeed, and blind should we have been to plead lack of time to witness an experiment of such moment,—a bio-oscillator "in beat" with the earth's or nature's "vital charge"! We assented by acclamation.

"Well, then, to the details," continued Dr. Thurston, briskly. "Animals and plants, no doubt, live in closer harmony with the earth's life than human beings; and my own conjecture is that plants are more synchronous with the elemental life than animals, for the reason, perhaps, that they are rooted in the soil. At least my co-laborer here, Miss Althea Estes, is of the opinion that she establishes the symbiotic continuity with the earth more easily and more completely by the use of a tree as an intermediate connection, or conductor. Is there a near tree?" the Doctor asked, stepping to the window.

A very fine sugar maple stands about twenty meters distant from the end of the building, and a large, very vigorous apple-tree nearer still.

Dr. Thurston rapidly looked the locality over. "If the weather were not quite so cold, I should suggest that we adjourn to one or other of those trees," he observed. "For Miss Althea Estes has a feeling that she acts most effectively when standing erect, with her back to the trunk of a living, large tree. The tree, she believes, assists her as a kind of conductor; but a copper wire connection with the tree also aids her, she believes; and this opens the very interesting question whether the earth's life is identical with the earth's electrical 'charge,' or whether, as is most likely, it is a factor or ingredient of it, and can be conveyed with it as by means of a wire. I do not undertake to say anything as to that; I do not yet know as to it. But would it be convenient to make a connection with that apple or maple and bring the wires in here?" Dr. Thurston asked.

In a few minutes a coil of rather heavy copper wire was carried from a window to the apple-tree, bent three times about it near the ground and returned, both ends being connected with a metal plate placed in the bottom of the chair in which the lady was to sit. Some fragments of plate glass were also brought and the chair insulated by placing one beneath each leg.

"Some of these details certainly look like hocus-pocus," Dr. Thurston observed. "I do not undertake to endorse them in the scientific sense; it is simply our experience, or rather Miss Althea Estes's opinion, that they aid her.

"And now there are a few additional details which, by rude minds, might be misunderstood," the Doctor continued, "but which will not here be thought to militate with delicacy. It is necessary that the five persons present who participate shall sit in a circle, the chair of each being insulated, like that of Miss Althea Estes; that we should clasp hands, and further to facilitate the symbiotic connection, that our bare feet should either be in contact, or all of them touch a metal conductor, resting on an insulator.

"Undoubtedly the best results in symbiotic healing are obtained by bringing the entire body of the patient in contact with those of well, strong persons," Dr. T. went on. "This in fact is a matter of history and observation from most ancient times down to the present. By contact of the entire body, or large areas of it, something nearest like direct protoplasmic contact and direct symbiotic connection is obtained. But our natures and habits at present have their limitations and infirmities; and compromises have to be made, even although such may impair the efficacy of our efforts.

"A perfect scheme of symbiotic healing would be to bring the bodies of a score or more healthy, strong persons into plenary contact with the patient. But as that is not at present practicable, we do what we can do with due regard to human weaknesses.

"Observe, please, that I am not attempting to teach anything as to the nature or the manner in which the symbiotic healing impulse acts; I do not know. It may be an ethereal current, wholly distinct and *sui generis;* or it may be a form or mode of electricity; or again electricity may be the vehicle or medium by which it is conveyed from one organism to another, or from one protoplasmic cell to another. What we shall attempt to demonstrate to-day is simply the fact that a sensible impulse, presumably of a bio-dynamic nature, is actually imparted."

A large hollow copper globe about eighteen inches in diameter, which had once been used in the laboratory as a species of small storage battery, was brought forward as a means of symbiotic pedal continuity, if this detail of our experiment may be thus described.

Heat, meantime, had been admitted to the room and the temperature raised to about 80° Fahr. An ante-room was made to serve the lady as a dressing-room. Each of the others made his preparations; and at a signal from Dr. Thurston, all approached — in slippers — and took their places, the one lady setting us all a beautiful example of utter unconsciousness of any other sentiment than a purely scientific one. That example the rest of us followed so chivalrously that the Neophyte alone was afterwards able to declare that "it was a regular

Trilby foot — two of them — a perfect daisy of a foot!" But the Neophyte is still a very young man.

Such, then, was the situation: our hands clasped, sitting in a circle on insulated chairs, with all our feet pooled about that copper globe which rested on a large pane of glass placed upon a low footstool.

Dr. Thurston held the lady's left hand; the Neophyte, rogue, had her right hand. We fixed our eyes on the circle of feet about the globe and sat in silent, but far from sad, civility.

Several moments passed. The Bio-oscillator seemed, I thought, to draw in deep breaths which expanded her grand chest. She appeared to concentrate herself as if making some sort of effort. Then presently an unmistakable impulse was felt, similar to a slight faradic shock. After another deep breath on the part of the Bio-oscillator, this was repeated more perceptibly, three times.

"I feel something," said the Neophyte. We all acknowledged that we did.

Without rising, conversation was resumed for some minutes, then another effort was made, when four or five distinct, moderately powerful impulses were communicated. There was no doubt of their reality. The only question was as to their nature, whether electrical or what?

Miss Estes herself made no attempt to explain anything; Dr. Thurston did the talking. His idea was that Miss Estes was symbiotic with nature and in period with the earth's "vital charge."

"But I do not deny," he added again, "that electricity may be the medium or agency by which the symbiotic impulse is imparted. I only know of it that it appears adequate to cure disease. We have been unusually successful with nervous diseases, some of them inveterate cases."

Still a third illustration was given, and I then bethought myself to introduce a galvanometer into our circle; but the lunch bell had rung, and one cannot ask a lady to sit barefoot indefinitely.

Our two visitors remained to lunch with us, and a remarkably pleasant hour was passed ere they took leave. Dr. Thurston proved a wonderful conversationalist, Miss Estes an equally wonderful listener. Little part as she seemed to bear in the conversation, however, we began to perceive that she was the directing spirit of it; her manner simply of attending to what was said led others to continue or to drop a subject.

As they rose to take leave she remarked to the '87 Graduate that

Dr. Thurston and herself were trying to make progress with the abstruse subject of symbiotic healing, adding that they also had their way to make, and asked that we would kindly certify, in writing, briefly, to what we had seen, but neither more nor less than the facts.

"Certainly, to what I have seen, or rather *felt*, I will bear witness most cheerfully," replied our associate, diplomatically. "But the subject is so interesting that I wish you would give us a fuller knowledge of it and a greater opportunity to certify. Will you not come again to-morrow, or soon, and let us see more of your gift?"

Miss Estes hesitated for the moment. "I do not know how Dr. Thurston may have planned his engagements," she said; "I will speak with him as to that."

They consulted briefly, when the Doctor said, "Willingly, and thank you for the invitation. To-morrow at the same hour, if that will suit your convenience."

They then drove back to the village at the railway, where their arrangements had been made for visiting us.

For my own part I had hastily jumped to the conclusion that the lady was one of those by no means very rare individuals known as "electric girls," something in whose physiological economy constitutes them living, walking electrical batteries. I had little confidence in the earth's "vital charge," as postulated by Dr. Thurston, but a great deal of confidence in electricity, even as a remedial agent in some forms of disease; and by the use of a galvanometer introduced into our circle of clasped hands when they called next day, I anticipated proving beyond doubt that the "symbiotic impulse" of the Bio-oscillator was an electric shock.

Talking the matter over before the laboratory fireplace that evening, — for cold squalls were howling down from the White Hills, — I cited the cases of our two most celebrated "electrical girls," and ventured the opinion that Miss Estes would prove an equally celebrated third.

The Neophyte laughed.

"The Bio-oscillator is a fine, grand, wholesome sort of woman," he exclaimed, at length. "But she is an actress, I take it, and I will bet my new sheepskin that she has got either a little storage battery or a dry salts battery under that classic tunic of hers. That's the kind of 'electrical girl' she is, take my word for it; and how to find out in a decent, slick way just what kind of an outfit she is carrying around is what I'm studying on to-night. For it will never answer to let that precious couple come here and do us out of any kind of an endorsement."

The Neophyte, as will be seen, is still in the gall of latter day bitterness whose unregeneracy not even the wand of Venus can temper. Amarah! but these youngsters of the last few graduating classes would suspect the mother of God.

The '87 Graduate and myself were scandalized.

"And I have it!" exclaimed the Neophyte, unabashed. "I have it. Just you all keep quiet to-morrow and watch out; you may hear something drop."

Next morning we heard him hammering down in the basement; he bored holes, too, in the laboratory floor. It disturbed the '87 Graduate, who was inoculating guinea-pigs. "Hope that young cock-sure will not outrage decency and common politeness to-day," he said, testily. "He has started up a faradic battery down-stairs; I heard it buzzing when I was in the basement."

Our visitors came at ten in the forenoon, as on the previous day, and after greetings and pleasantries, we prepared for another exhibition of the lady's powers as a bio-oscillator. The same arrangements were made as on the day before; the chairs and copper ball, in fact, had not been removed from their places, and we sat down in the same order as previously.

Again, after a few moment's silence, we felt a faint impulse, then a second and third. In the interval of time which succeeded, Dr. Thurston told us of a case of locomotor ataxia which they were treating in Philadelphia, with a marked improvement and apparent arrest of the progress of the disease.

Another exhibition of the symbiotic impulse was attempted. We had joined hands. As if inadvertently, the Neophyte then moved his heel, when, shade of Volta! we were all brought to our feet simultaneously, and the copper globe spun round!

The Bio-oscillator screamed, then flushed and panted. Her clear gray eyes searched our faces, seemed to read our souls and rested on the Neophyte with a magnificent sparkle of anger.

But only for the merest instant. An equally grand burst of good temper and abounding *bonhomie*, such as only a great soul in a healthy organism will rally to, succeeded it. She laughed outright.

"Oh, you bad, ridiculous young man! That was n't nice a bit. You hurt me, you did!" she exclaimed, in mellow outcry, her face suffused with color, and one great tress tumbling wildly down her cheek.

"Oh, I confess," she continued, reading our faces intuitively. "You have trapped me. Oh, but you did it cruelly" (this last to the Neophyte, who stood watching her, agrin). "I own up. I make a clean breast of it. You shall see just how I managed it," and with an impulsive movement of both her hands she undid first a brooch, then her dress from the neck, and amidst a frou-frou of pink laces hastily unbuckled and drew forth a long, wide, thick belt that encinctured her person.

The '87 Graduate and myself were too greatly perturbed to direct anything more than casual glances to this bit of apparatus; and as for Dr. Thurston, he seemed like one who is with difficulty keeping up with the rapid course of events. But the Neophyte says that it was some sort of electrical battery, consisting of the usual elements, contained most ingeniously within insulating substances and an outer sack, provided, too, beneath the left arm, with a circuit closer which could be opened or shut by alternating pressure of the elbow, or upper arm.

Miss Estes threw the belt across her knees, for we had sat down again, and fastened her brooch. "Now, you think that I have tried to play a trick and that I am an impostor," she said, frankly. "In a sense, I did; and in a sense, I am. Yet I am not wholly an impostor. I honestly believe in symbiotic healing, as does Dr. Thurston. I believe that I actually cure patients and do good. I cannot doubt it, because they get well and remain so. But I have found that the symbiotic impulse is more effective when accentuated by a current of electricity. I do not know why; perhaps the electrical current aids to convey a vital healing impulse from me to them; perhaps it is merely because the sensible shock of it aids their faith and gives their confidence something real, tangible, or sensible to hang upon. Who shall say? How much of all medicine, homœopathic, allopathic, is faith? There is the faith cure, simple, and 'Christian science,' which is but another name for the faith cure. It is plain that faith on the part of the patient is a factor of some importance. It is desirable at least that the patient should have faith. In symbiotic or vital healing, however, we claim that an actual current or impulse passes from the physician directly to the patient; I know this to be the fact from the sense of exhaustion which I experience after treating the sick. After even a few hours nothing save sound sleep and good food will restore and recharge my nervous system. I actually give them largely of my life, my vitality. Hence my own profound faith in my art.

"We do it but badly yet," she continued, with a sigh, and re-arranging her fallen hair with an absent movement of her fine arms. "When I see people suffering, dying, and think what might be done by symbiosis, if only we could in some way organize and get into vital connection, so as to bring the strong combined life currents of a score or a hundred or a thousand healthy human organisms to bear on one sick person, why I am sometimes quite transported by my faith and believe that miracles of healing, like those described in the New Testament, might be wrought. I do believe it. And is n't that really what Christianity means, this new altruistic phase of it namely, the combined and controlled action of our vital currents to cure disease? To rectify error and set all the erring right by a universal consonance of vital action; by getting 'in beat' or harmony with Nature's life, and working together to secure the health and well-being of all humanity."

The woman seemed transfigured by her earnestness and her enthusiasm. An actress she may have been, a grand one, but there could not be the least doubt of her earnestness and of a great ardent purpose actuating her. The incident of the belt, which she twirled in her hand as she made her appeal, suddenly sank to the insignificance of the old family physician's bread pill; nor was it even reverted to while they remained our guests.

It can hardly be denied, however, that there was something resembling an attempt at deception — an attempt to give us the bread pill — which rankled a little afterwards.

But the Neophyte, with all his young hardness of heart, had forgiven it out of hand, quite forgotten it.

"She 's a good egg!" quoth he, looking regretfully after them as they took leave and drove away. "She 's a peach. I would like her, myself.

"I served her just right, though," he added, reflectively. "She knew that I did, too. But oh, did n't she face the music good and large!"

"But now how do you put it up about Dr. Thurston?" the Neophyte suddenly resumed that evening, before the fire. "As near as I can differentiate it, he was as much at sea about that belt as any of us. I don't think the doctor was in it. I think that was a little private risk of her own, and not a part of the firm's regular business."

The subject seemed to weigh on the Neophyte's mind. He sang and whistled softly to himself as he filtered agar-agar next forenoon; but he used up filter paper by the sheet.

"Now that was a grand idea. I don't see how it ever found place in a woman's head," he observed to the '87 Graduate.

"What, the belt?"

"Oh, no, no! that idea of symbiotic Christianity; that scheme she broached of uniting a thousand or so of healthy persons and, by some special apparatus, combining and concentrating their vital force on the sick to cure them. I tell you that was a big idea. I take stock in it, too. There would really be something *to* religion, then. That would be taking hold of the world's ills to some purpose. That would be business. That would be the millennium, would n't it? Why, I never knew what that word really meant before."

## AN IMPASSIONED SOCIALIST.

PROFESSOR HAMLINE remained with us but half an hour, and would probably never have found his way to our laboratory in this out-of-the-world corner of Down East but for the death of a relative whose obsequies he had come two thousand miles to attend. Once in Maine, some whiff of local rumor that certain persons were looking into the causes of old age with a hope of prolonging life, piqued his curiosity and led him to call on us. Perhaps I should rather say militated with his Idea. For the mien of our visitor was from the first that of dissent and superior wisdom; yet he appeared to think it worth his while to call and set us right.

Hence, on one dripping wet afternoon last April there appeared at our door a tall man of thirty-eight, it may be, of somewhat striking physiognomy, hair and beard glistening black, and an irregular, high, white forehead; a remarkable head for height, but of short antero-posterior diameter. In a long, black, dripping mackintosh he was personally a remarkable figure, with a flavor of Munkatsky about him and a suggestion of the Parsee.

Our particular work that day was on the brittle old hip bone of a woman, bed-ridden for ten years, at the age of eighty-eight; a sad object lesson in itself. The compact osseous tissue had thinned to a perilous shell. Even the cancellous tissue had been much reduced by absorption; a mere old sham of a bone which the slightest fall or even misstep might break. Contrasted with the "control" bone from a young adult, it was indeed a pitiable earnest of the present fate of aging, dying man.

Our visitor who had been made welcome and invited to see the day's work, examined it with a certain interest, but an interest manifestly measured by a dominant idea of his own. This delimitation of his sympathy was presently made more apparent by a leading remark; and this proved the harbinger of a plenteous outpour of his opinions which were evidently fervid convictions, hot from the man's heart.

"I grasp the central thought of your work here. I see the hope you hold and the line of effort you are following," he exclaimed, at length. "But do you not perceive, can you not realize, that this conception of yours will never eventuate in what you hope for? That from its very nature it is un-moral and on a wrong course, and hence ought not to succeed?"

This question was put forth with a solemn frankness which fairly relieved it from any trace of rudeness; and the '87 Graduate replied, civilly and pleasantly, that we had not been much disturbed by such views or aspects of our inquiry.

The University Professor from beyond the Mississippi penetrated us with his earnest dark eyes in silence, for a moment.

"Let me make plain to you the later grander conception of Christianity, the Christ idea of self-sacrifice and service, which is the foundation and the basis of our new social science," he said, with zeal suddenly unchained.

"Your effort here aspires to the culture and perpetuation of self, to the preservation of individuality, to the apotheosis of separate human personality, the indefinite prolongation of individual life. But that is all wrong from the beginning. The idea is wrong at the outset. It is the road to Death, not to Life, that you are following with such a painstaking of research."

"How so?" queried the Casual Worker.

"Because it is a retrogression to self, a segregation and an isolation of life in self. Whereas the higher life, the only life worth living, is an abandonment of self, a living outside and beyond self, in the greater life of Humanity. There is no other real happiness save in that self-abandonment and self-surrender in the social life of the entire human race. We live and are immortal only as we throw our lives into the one great Life which lives on from century to century and from æon to æon. Individual, bodily life is valueless, worthless, Christless, save as it casts itself into the social life. Hence, he who would save his life by personal effort loses it utterly from the very nature of life's essence. All these separate struggling human efforts to amass personal wealth and achieve personal fame are on wrong courses and eventuate in sorrow and confusion. Such efforts carry the unhappy devotee of self farther and farther from the great, true Life of Man which ultimately is the Life of Deity. To live for self and lay up treasures, either on earth or some hoped-for heaven after death, *is to leave Life and die!* Those who thus live for self-salvation and self-advancement are moral monsters who stray off far from

Life and God. Their lives are hid not in God, but in dark holes of the earth, apart from Life. They become, in very truth, lost souls."

"But these are generalities," remarked the Casual Worker. "Your conception, to be fully clear to me, needs restriction to the everyday conditions of our lives. You assert that we are wholly wrong, at the outset. Now pray be a little more explicit. Do we understand you to say that there is no such thing as personal or individual immortality, that the hope of it and wish for it are improper and immoral?"

"I mean rather that such a wish is of the nature of a mistake, an effort in the wrong direction," replied Prof. Hamline. "It is contrary to the moral order, an erratic aspiration which would bring no real happiness with it. That is not the way to live. Perpetuation of self is an anomaly of life, a contradiction of the very terms of life, a *reduction ad absurdum*."

"But you speak of 'God,'" the '87 Graduate objected. "Under your last deduction, 'God,' if a living personality and a self, cannot be immortal."

"God is the Greater Life of all humanity, the Life of all terrestrial life, and not only of terrestrial life, but the Life of all life in the universe, of unnumbered globes and spheres in outer space, the Whole Life of cosmos," rejoined the Socialist. "This grand life is infinitely higher in degree and in quality than the life of any organism, animal or human. This grander life is to the personal life of a man as the life of the entire brain, the intellect, is to the life of a single cell of the brain. It is something loftier, more intelligent, divine and omniscient, something to which the individual self-life could never attain in quality, even if it could prolong itself for a thousand years, or a million. You see now why I think you are going wrong. You see now what I mean by coming out of the self-life and rising into this grander life of all humanity. You see now why self-perpetuation, if possible, would be a mistake and an impropriety, a contradiction of the moral order, a failure to develop. It would be like the survival of some old reptilian type which in the natural progress of species should have become extinct. It would be retrogression, not progress."

"But what is your method, your formula, for entering into this greater life, for leaving self behind and rising into the higher life of 'God,' as you describe it?" the Casual Worker asked.

"Simply to forget all personal cares, all worries and fears about self. Cease from self-consciousness and all selfish, personal plans and schemes, and with these will vanish envy, pique, resentment, hatred, grudges, desire for revenge, and also the fear of disease and death. All such miseries pertain wholly to self. As soon as you forget self these disappear from the intellect, and you are ready to rise to the higher life. With the effacement of egotism, moreover, sex-lust ceases to be felt, leaving in its place naught save a passional love for every other fellow-being."

"Even if it were possible to become thus self-forgetful and yet live, of what is one to think?" questioned the '87 Graduate. "For one must think of something, or become cataleptic."

"Enter without self-reserve into the life and interests of all men," replied the Socialist Professor, with enthusiasm. "Into our national life, let us say, into all the great social and public questions and enterprises of the times. Immerse yourself wholly in them. Work and *live* in them. Transfer your personal life from self into these currents of the national life. Throw your life into them. Life is an etheric current in the brain. Instead of allowing it to spend its force there, as a useless, tiresome *eddy of self*, direct it outward into the great attractive currents of all human life, or, as I said a moment ago, into the national life of these seventy millions of people in the United States.

"The moment you really succeed in doing that, in diverting your personal vital current out of your own confined organism into the great social current, you will experience a sudden thrill of the most exquisite happiness, a joy that you never felt before. You will then catch your first intimation of what the higher life is. As plainly as if God had spoken to you will the revelation what this new higher life is come to your mind and your heart. You will realize then how futile, meagre and undesirable self-life is. You will see then what I mean when I tell you that a personal, self-immortality, either in the body or out of it, in some mythic 'heaven,' would be worthless, wrong, and immoral, a solecism, a retrogression, a reversion of the intellectual type. The moment you enter this grander life and feel the new joy and thrill of it, you will cease, as in the twinkling of an eye, to wish to live in any other way. The desire of continued self-life will cease. You will no longer desire an immortality of self on earth, or in 'heaven,' for you will feel that you have found something better and nobler. This is strictly a physical process, the rising to a higher plane of mentality. Not all the treasures of earth nor the promises of 'heaven' would tempt you to go back, or accept immortal self-life. For you have been rescued from self, and you will feel and know, absolutely, that your 'soul' has, indeed, been saved. For the only 'hell' is the hell of self.

"And this," continued Prof. Hamline, "this life in the common life is the Christ-life. This is the great truth which Jesus sought to teach humanity, the salvation of the human soul by self-renunciation and self-sacrifice, — a transfiguration as demonstrable even in terms of energy as is the transformation of heat into volts of electro-motive force. This great new idea was the corner-stone of Christianity. It is the keynote of modern socialism."

"And the human longing which we all feel for continued life, for immortal life, what of that?" queried the Casual Worker.

"It is but a spasm of *self;* it passes and ceases to be felt when once the self and self interests are thrown forward into the higher life," replied the Professor. "There can be no fear of death when self is renounced, no dread, no sting, for all these emotions spring from egotism, or egoism. Why, don't you see there is no longer a self to die, or to fear death for? You have passed from death unto life. You have already, before the cessation of the organic functions, entered immortal life as a part of the higher Life of Man. You have no longer anything to do with the thought of individual immortality, either in the body or as a disembodied soul. You are *saved* from that; for this is the real salvation of Christ, the transfer of the human soul or intellect from self into the greater, grander life of the universe. And when once we feel the thrill and the joy of entry into that grander life, we gladly abandon self-life and go to it, as to heaven."

"But this natural abhorrence of death, this dread of ceasing to live, is deeply implanted, at least in me," remarked the Casual Worker. "How shall I begin to abate it, or even to lessen it?"

"By love, just as Jesus taught; by love for all men, love for all one's fellow-beings, the passional giving of one's interests and efforts for their good. Jesus experienced all this. He opened the way, and showed us how to leave self and the fear of death and rise into the heavenly life.

"And now can you not see that this enterprise of yours at this laboratory is retrogressive and reactionary? or in plainer language, that you are on the wrong track, and that your very success would defeat itself in the act of succeeding?"

"You put us on our defence," replied the '87 Graduate, laughing.

"In reality this is the old question of individualism as against communism and pantheism. In India, thousands of years ago, they sought to work out this conception in Brahminism, and later in Buddhism, where the leading idea or tenet is escape from individual life into *nirvana*, the peace of universal life. I deem it quite possible to so train, discipline and school the mind and its emotions as to throw one's personal interests, hopes and fears from self to humanity as a whole. I think that it can, as you allege, be done to a considerable extent, and that a certain solace may be found in it. As a makeshift to assuage the personal fear and hardship of death, it may even be advisable, since it usually redounds to the public good. A person may meet death the more bravely for it, and even die happily in such disciplined self-surrender. To those who cannot achieve prolonged personal life it may even be an allowable solace. Temporarily allowable, I mean, for a few centuries or a few thousand years longer, but not ultimately, or as a final law of life."

"But it *is* a final law of life!" Prof. Hamline interposed.

"On that point I differ from you, radically," replied the '87 Graduate. "I have no wish for an argument, however; discussions of individualism *versus* communism and pantheism always end weakly and wordily. But the facts from histology and biology are all for individualism and for that self-life which you so much decry. Not for a disproportionately selfish life, but for personal intellect and character. The grand science of physiology is a well-nigh perfect argument for individualism. The argument from the cell which you have brought forward, *i. e.*, the union of cell lives in a human intellect, as illustrating and proving your position, is, when understood, a complete refutation of that position. The evolution of life on the earth has been the development of *self*, from first to last. From unicellular life upward through metazoans to man, the aim and *motif* have been to give field for individuality and personal self. Not only do the united brain cells live consentiently in order to utter a strong personal life, but by the very act of thus uniting, they have each been made stronger and more forceful as cell selves. There can be no general weakening of cell self without slackening and failure of the entire organic life.

"It is not otherwise with the life of a nation or of humanity in its relation to the life of each citizen, or human being. For what is the nation? What is this humanity into which you exhort us to throw ourselves and renounce self? What is it but a million or a billion of our personal individual selves? Nor is it, as you claim, a grander or higher life than that of the individual man or citizen. On the contrary, it is notorious that the character and morals of nations are never as high or lofty as the life and character of any good citizen. Every great nation of the earth to-day is living a life in its foreign and domestic policy such as any honest, educated man among us must despise and condemn. How, then, can we cast ourselves with full sympathy and veneration into that which is lower and baser?"

"To make it purer!" interjected the Socialist Professor.

"Oh, that indeed, but that is not the point here at issue," rejoined the '87 Graduate. "It is the question of a loftier, higher life. But a national life, or a life of all humanity, is an abstraction, at best.

"A nation exists only in the selves of its citizens. The best citizens of a nation, too, are always the men of strongest, staunchest self-life, who make their personality a dominant force in the nation and in the world, the men who from sheer force of self and personal character *break out of the common national* life and lead it upward to something better. What would the world be but for such men? And what are they but powerful eddies of personal self? Why, Professor, your argument for the abatement of self is contrary to the course of nature and matter. The sentient atoms unite in a cell which sets up at once a personal axis and could not live without one. The human organism is composed of cells, but each cell retains and maintains its personal self-axis. You could not have a human intellect without these millions of cell selves. If they were each to abandon self, there would be no personal human self. It is only by virtue of the component cell selves that the larger personal self of a human life comes into being. When you strike at the principle of self, you unwittingly deal your ideal life of pan-humanity a mortal blow. You obliterate it at its source.

"Again, practically, as we now lead our imperfect lives, a young man must live shrewdly and diligently for self to earn a competence, make a home, select another female self as a mate and bring other young selves into existence. To do this he is absolutely compelled to think for self and work for self and be very decently selfish. If he failed to do so, where would your 'grander life' of humanity be in the course of thirty or forty years?

"More practically still, it seems to me that you ought heartily to endorse our idea of prolonging personal life, for if human beings did not die so constantly, after a brief lifetime, they would acquire greater stores of knowledge. Instead of being mainly lost by death, as now constantly occurs, there would be a conservation of knowledge and experience in the individual. Men would be wiser and live more correctly, and thus 'the higher, grander life of humanity,' on which you lay such stress, would be elevated and improved, since the 'Life of Man' is but the sum of individual lives and its wisdom but the totality of human knowledge."

"Oh, but—you fail to grasp my idea!" exclaimed Prof. Hamline. He began to elucidate again, but merely iterated his dominant idea, the idea of the Christ-life.

The '87 Graduate resumed confidently, and the argument would no doubt have lasted the day out and ended "weakly and wordily," but that our visitor's stay was limited by a railway time-table.

"If I had but the time!" he exclaimed, impulsively, at the door, "I would convince you; I am certain that I could. I utter a great world truth which must reach you in time."

"You have truth, no doubt, but don't think that you have all the truth," said the '87 Graduate. "Truth is like the universe, boundless, infinite."

"And thank you for coming!" exclaimed the Casual Worker. "Come again and have it out with us whenever you can. The truth is what we want here. Meantime, let us have an abounding charity and toleration one for another, for that is in the 'Christ-life,' too, is it not?"

So with a "charity" hand-shake all around we parted; yet the Professor went away with a baffled wrinkle in his brow, as of one reluctant to quit the field till he has silenced all his enemy's guns.

The ardor of combat still lingered in the '87 Graduate's eye, also.

"What a purist! What a stark, staring purist!" he exclaimed, as he watched the Professor striding rapidly down the misty path. "When one of these college professors sets up as a socialist, good-by to all moderation and common sense."

"But he has an idea," said the Casual Worker.

"An idea! yes; the idea of a termite communist, a bee-hive socialist."

"But who knows? Perhaps a white ant republic is the best that can be done by humanity on so hard and baffling a theatre of life as this bleak old earth," remarked the Casual Worker, thoughtfully.

"What a lack of faith!" exclaimed the '87 Graduate, warming for battle again. "Why, every step in the progress of humanity has been due to the heroism or the hard work of the individual, the scholar, the statesman, the military chieftain, the artist, the scientist. Always to the single man, the individual, never to the herd of men. And this modern communistic effort, what is it? Rightly estimated, it is all for the individual, all to give the common man a better chance to live, develop, and enjoy his life than was possible under the old conditions. I boldly assert that modern socialism, altruism, communism, 'anarchism,' 'nihilism,' all are but the struggles of individualism for a higher recognition. It is a great spontaneous throe of humanity to give the obscure poor man fair play, to give the common individual an equal chance in the world. In one word, it is individualism."

# THE PLATINUM SPHEROID.

THERE was a good north light that forenoon, favorable to the use of oil-immersion objectives of high power. It was one of those windy, dark-green June days such as often precede the first really hot week of summer in Maine; a day when the freshly opening foliage and the cool temperature combine to impart a sharp-edged definition to the light. Such are halcyon days to the microscopist who learns to wait on the photo-delineative moods of nature.

I was improving the chance to examine again, from a series of recent slides, the pigment granules in cortical cells from the human cerebrum, granules such as are observed to increase in number and in size with advancing age, when the gong of the laboratory door below struck twice with startling suddenness.

Visitors, in truth, are not numerous with us at that hour, since trains from Boston and the great world outside rarely arrive till late in the afternoon; and the *indigines* have their own opinion of a place where human tissues are an object of study.

"Another of those commercial fellows," I thought, "come with practised guile to sell me something or other, warranted 'chemically pure' — same used by Dr. Koch, in Berlin — recommended by Pasteur." Thus the tale might proceed, and to obviate the possibility of the fellow getting inside, I was minded to hail him from the window, but finally, taking my own time about it, went down to the door.

A young-adult man of somewhat unusual appearance was standing there, examining a specimen of amethyst crystals which lay on the piazza; and he at once relieved himself of all suspicion of mercantile antecedents, by betraying a marked trace of hesitation and embarrassment.

"I am a stranger," he remarked; "but I have a letter of introduction from Prof. Whittlesey, with whom I think you are acquainted."

"Prof. Whittlesey is my friend," I said, and immediately asked the caller to come indoors. He entered and gave me the letter.

Under address of New York City, Professor W. had written as follows: —

> "The bearer of this note, Mr. Lafayette C. Gladwright, is of the opinion that he has something of importance to communicate to you in relation to those investigations in biology which you are making an object of study.
>
> "I am not informed as to details of his communication; but I imagine that you would find the matter of moment.
>
> "I have no need to say that Mr. Gladwright is a young gentleman of scholarly attainments, for that you will immediately discern for yourself; but to his worth and genuineness as a man, I can confidently certify, and will add that it gives me sincere pleasure to make you known to each other."

Meantime the driver, who had brought Mr. Gladwright from the railway, with difficulty fetched a very heavy chest indoors; and perceiving that my visitor might remain for a time, I made haste to tender him possession of the laboratory guest room and bid him make himself as comfortable as possible after his journey. I now noticed that a stout cane which he carried was for actual aid in the matter of a slight lameness; also that personally, although young and of otherwise fine physique, he was inclined to delicacy, being of an apparently high nervous organization, with that lofty, predominant forehead which is commonly held to be the co-relative of fine intellective powers.

"Make this matter of your visit entirely one of convenience and comfort to yourself, please," I said to him, and for the time being returned to my pigment granules.

There after awhile he joined me, but very quietly, and for an hour or more continued in contemplation of the nuclei of several age-shrunken cells. I found with pleasure that he was well versed in histology.

It was not till after lunch, indeed, that he made any allusion to the object of his visit, hinted at in Prof. Whittlesey's letter. He then entered upon it tentatively, by remarking that he had made himself conversant with the ideas published in *Long Life*, and that he fully believed that the human organism furnished the material basis for a prolongation of healthy, normal life, not only to the age of a full century, but two, even three centuries; that the evolution of life on the earth has not ceased with the semi-brute man, but will proceed in time to come, from mortality to immortality, from manhood to godhood; that science is the index of human evolution; that the present erratic human belief in the immortality of the soul will yet be practically realized in the achievement of prolonged life by applied science.

It was pleasant listening; I could but feel satisfaction in this evidence that another human being in the world had honestly and enthusiastically accepted these great truths of nature and life; yet thinking this, I could but feel a little curious, too, as to what all this ardent discipleship was leading up. My visitor appeared to divine this thought.

"I will at once explain my purpose in coming here, if it will not encroach on your day too much," he said. "But first may I ask you to assist me for a moment to fetch in my chest. I would rather you did not call a servant, or even an assistant."

We brought in the chest from the hall where the toiling hackman had deposited it, — a strong, copper-bound trunk which must have weighed at least two hundred pounds, and so much resembled the sample chest of a traveller in the hardware line, that for an instant the suspicion returned that possibly after all I had fallen under the spell of a preternaturally adroit individual of the genus. Nor was this obtrusive thought wholly reprobated when my visitor, with a deprecatory smile, unlocked the chest and from a padded compartment raised a ponderous, ashen gray spheroid, or rather a prolate ellipsoid, apparently a solid bolus of metal, which, at first glance, I surmised to be of iron, galvanized.

The major diameter of this formidable mass may have been fifteen inches, the minor about eleven. Mr. Gladwright lifted it by main strength and deposited it on the laboratory table.

"Are we quite alone here?" he asked, with a glance toward other doors of the room.

"Quite alone," I replied, thinking to myself, "It is probably not a bomb!" Noticing, too, that my visitor appeared not wholly reassured, I stepped to the hall door and locked it. "We shall not be disturbed. No one will come in," I said.

He passed his hand over the smooth surface of the spheroid, with a singular sort of proprietary glance. "Do not feel annoyingly mystified," he said, laughing.

"No? It is not the roc's egg, then?" said I.

"Greater things may yet be hatched from it," he remarked, applying the palms of his hands laterally to the sphere, giving them a turn apart, when the fact was disclosed that the spheroid was in conical halves, connected by a screw thread.

Ten full reverse turns were required to separate the halves. Within them was a cavity into which fitted, when the halves were joined, a box of the same gray metal, of about the size of two ordinary bricks, laid one upon another, or four by eight inches. The box was provided with a slide top or lid which, when opened, was seen to contain a large number of plates, twenty-five, I think, each not far from three and a half inches square, by perhaps a quarter of an inch in thickness; all were of the same substance as the box and the spheroid containing them.

My visitor placed the plates in an orderly row on the table, and taking up the first to the right, handed it to me, saying as he did so, "These are all of platinum, a metal which is, as you know, practically infusible."

"Of platinum!" I said. "This must have cost you a good bit, then, altogether."

"It is expensive," he replied. "But a substance which resists a very high temperature was required. In fact, I have been able to fuse, mould and stamp it, as you see, only by the aid of the oxyhydrogen blast and the new electric heating process. The spheroid is platinum, slightly alloyed with iridium for greater infusibility and these plates would prove even harder to melt down, for I have succeeded in alloying them slightly with osmium. It is all the work of my own hands.

"I have," he added incidentally, as an afterthought to my remark as to the cost, "a fortune which comes to me from a mining enterprise.

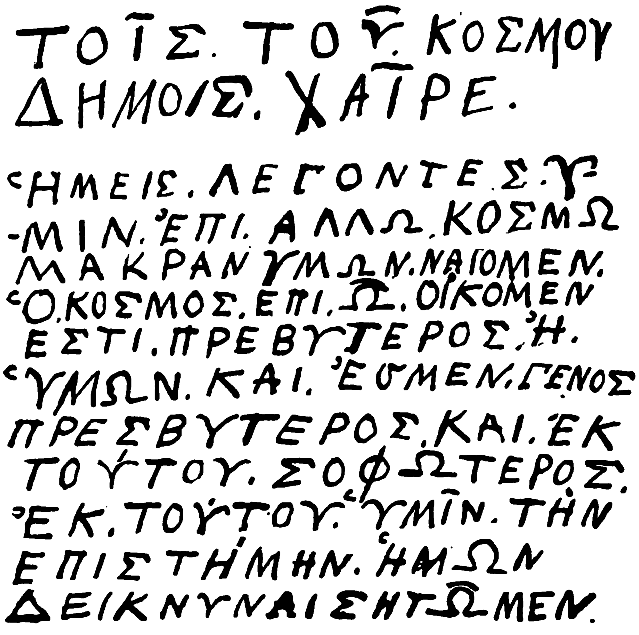
"And I can say positively," he resumed, "that no one knows of the existence of these plates save myself and yourself, within the last five minutes, and one other. This is a point of some importance as will be seen presently. And now will you please glance at this first plate of the series and tell me what you make of it?"

The plate, as I have remarked, was about three and a half inches square, by a quarter of an inch in thickness. At first sight it appeared to be stamped on one side in pictures of the smaller annelids, and on the other was covered by an inscription in the characters of the Greek alphabet. The letters were irregular, however, and in this particular resembled those of very ancient inscriptions on the Attic temples.

"Can you decipher it? Do you read Greek?" Gladwright inquired.

"I have only the Greek of an American academic course," I replied. "If put to the test I might translate it. Certain biologists draw heavily on the Greek for new distinctive terms; and I try to keep within hail of the procession."

I reproduce from memory the aspect and the words of the inscription.



ΤΟῖΣ. ΤΟῦ ΚΟΣΜΟΥ
ΔΗΜΟΙΣ. ΧΑῖΡΕ.

῾ΗΜΕΙΣ. ΛΕΓΟΝΤΕΣ. Υ-
-ΜΙΝ. ἘΠΙ. ΑΛΛΩ. ΚΟΣΜΩ
ΜΑΚΡΑΝ ΥΜΩΝ. ΝΑΙΟΜΕΝ.
῾Ο. ΚΟΣΜΟΣ. ΕΠΙ. Ω. ΟΙΚΟΜΕΝ
ΕΣΤΙ. ΠΡΕΒΥΤΕΡΟΣ. Ἠ.
῾ΥΜΩΝ. ΚΑΙ. ἘΣΜΕΝ. ΓΕΝΟΣ
ΠΡΕΣΒΥΤΕΡΟΣ. ΚΑΙ. ἘΚ
ΤΟΥΤΟΥ. ΣΟΦΩΤΕΡΟΣ.
ἘΚ. ΤΟΥΤΟΥ. ῾ΥΜῖΝ. ΤΗΝ
ΕΠΙΣΤΗΜΗΝ. ῾ΗΜΩΝ
ΔΕΙΚΝΥΝΑΙ ΣΗΤΩΜΕΝ.

With some difficulty I contrived to make out the drift of it. The construction was peculiar. I remarked as much to my visitor.

Gladwright laughed. "It is peculiar," he said, "and for a particular purpose. Rather there is no proper construction. But it may be freely translated like this: —

"*To the people of the earth, Greeting:*

"*We who speak to you live on another earth, far remote from you.*

"*The earth on which we dwell is older than yours and we are older and wiser than you. Therefore we seek to impart our knowledge to you.*"

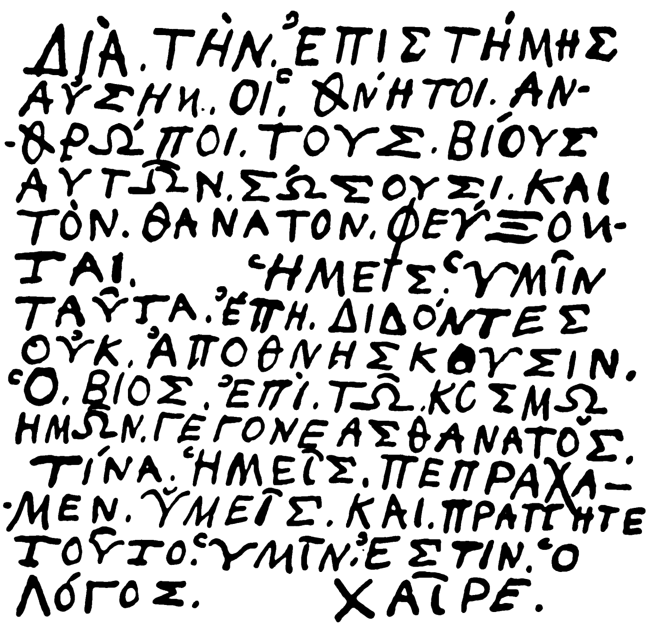
This plate was marked "*Alpha*," on the superior margin. The next plate, marked "*Beta*," had upon one side what looked to be fishes of many species, and on the other an inscription of which —

as I saw these plates but once — I remember only the first sentence which Gladwright translated as follows: —

"On every earth, life begins of itself and grows stronger as ages pass by."

From many of the plates which followed, I can now recall nothing verbatim, but remember of them generally that they treated of the progressive evolution of life from lower to higher types and of the parallel growth of intelligence.

One, toward the end of the series, made exhortation to the study of nature, the discovery of her great truths and the careful record and conservation of knowledge in order that it might descend from generation to generation. On the reverse side of the plates appeared, successively, reptiles, birds, land mammals, and then the different races of men, portrayed in an ascending scale from naked savagery to civilization, and thence upward to what looked to be more august, divine forms that moved at will, in the air, by some suggested method of self-levitation. Upon all the first picture plates were represented one or more dead creatures as well as many living ones; but toward the last of the series dead individuals ceased to appear; and, as well as I can remember, the inscription on the last of the twenty four or five plates was as follows: —



ΔΙᾺ.ΤῊΝ.ἘΠΙΣΤΉΜΗΣ
ΑΫΞΗΝ..ΟἹ.ΘΝΉΤΟΙ.ΑΝ-
-ΘΡΏΠΟΙ.ΤΟΥΣ.ΒΙΟΥΣ
ΑΥΤΩΝ.ΣΏΣΟΥΣΙ.ΚΑΙ
ΤΌΝ.ΘΑΝΑΤΟΝ.ΦΕΥΞΟΝ-
ΤΑΙ. ῾ΗΜΕΙΣ.῾ΥΜΙ͂Ν
ΤΑΥ͂ΤΑ.ἜΤΗ.ΔΙΔΌΝΤΕΣ
ΟΥ̓Κ.ἈΠΟΘΝΗΣΚΟΥΣΙΝ.
῾Ο.ΒΙΟΣ.ἘΠΊ.ΤΩ͂Ν.ΚΟΣΜΩ
ΗΜΩΝ.ΓΕΓΟΝΕ ΑΣΘΑΝΑΤΟΣ.
ΤΊΝΑ.῾ΗΜΕΙΣ.ΠΕΠΡΑΧΑ-
-ΜΕΝ.῾ΥΜΕΙΣ.ΚΑΙ.ΠΡΑΤΤΗΤΕ
ΤΟΥ͂ΤΟ.῾ΥΜΙ͂Ν.ἘΣΤΙΝ.῾Ο
ΛΌΓΟΣ. ΧΑΙ͂ΡΕ.

### TRANSLATION.

*By the growth of knowledge, mortal men shall preserve their lives and escape Death. We who give you these tidings do not die, but have become deathless. Life on our earth has become immortal. What we have done you also may do. This is our message to you. Farewell.*

My visitor replaced the plates in the box and screwed the halves of the spheroid together.

"May I ask what your surmises are as to the purpose of this?" he asked, suddenly.

The query embarrassed me.

The effort to outline, in imperfect Greek, the modern doctrines of the evolution of life and the future achievement of greatly prolonged life, done, too, in platinum, presented itself to me as disproportionate. There was no harm in it; but it looked like a flagrant instance of *parturiunt montes nascetur ridiculus mus.*

I replied in some confusion, with an attempt at cordial levity, that it was very ingenious.

Gladwright laughed, the first time he had really laughed.

"You do not then conjecture the object of this?"

"Why, I might conjecture that you were designing to transmit to distant posterity, or project to some other planet a sketch of the development of life on the earth."

"In that case, I should certainly have made use of better Greek, or rather good English. But the effort, at best, would be simply silly. No. My purpose is wholly different; and in explanation, allow me to begin by asking a question. What, in your judgment, is the obstacle which will most greatly retard the future development of human life, most seriously impede the achievement of immortal life?

"As to that," I replied, "the greatest obstacle will doubtless be the difficulty in convincing people that they are not inevitably born to die, as the dogmas of popular religion assure them. The world is indoctrinated with ideas to the effect that death is the proper, inevitable end of life, after a not greatly variant lifetime, but that the disembodied "soul" is immortal, and must be released by death before it can enter upon immortality. Humanity, the world over, is so strongly, so deeply indoctrinated with Buddhism, Mohammedanism, Christianity and other creeds, all to the effect that death is the necessary and proper sequence of life, that the best efforts of science will for a long time be in vain, to combat this hereditary indoctrination. So firmly persuaded are men, particularly religious votaries, that death is needful and even beneficial and beneficent, that it is probable they would die from this mental prepossession, if from no other cause. For the sway of dominant ideas over not the mind alone but the body as well is much more prevalent and subversive than we at present suspect."

"Assuredly. I agree with you fully and have long thought so. These dogmas of religion have been taught for centuries. Not only have the minds of adults been formed by such instruction, but the brains of children have received pre-natal capacity for the easy reception and belief of such doctrines. Hence, anything like scientific truth which makes its appeal only through the reasoning powers, must gain way but slowly against this ingrained indoctrination. Why, to the average Christian believer, the doctrine of the achievement of immortal life on the earth is simply preposterous. It militates with everything which he has been taught and holds sacred. In point of fact, such an achievement by the aid of applied science is not one half nor a tenth part as improbable and preposterous as the tenet of the resurrection of the dead, or that the soul survives the death and dissolution of the body. But here the bias of long-standing indoctrination quite overbears the natural logical tendency of the mind to reason from causes to effects. Inveterate dogmatism leads the average Mohammedan or Christian or Jew to believe the doctrine of disembodied souls; for he has been authoritatively instructed that these articles of faith have been guaranteed by supernatural revelations. Thus it will happen that a great scientific truth which might at once become the basis of an incomparably better, nobler religion than any now existing, will be a century, perhaps half a dozen centuries, making head against these old, long-indoctrinated delusions. Why, as much time may be required to uproot them in the brain of humanity as was required to implant them. They will linger and cling and continue to crop out, unless —" Gladwright paused thoughtfully.

"Unless what?" I queried, curiously.

"Unless all these old-time, soi-disant revelations are authoritatively contradicted, called in, so to speak, replaced and superseded by another newer, grander revelation!" exclaimed my visitor, impressively. "Some tangible simulacrum of authority which will appeal to the eye of the ignorant as well as to the reason of the educated."

"Do you desire me to surmise then, and am I at liberty to do so, that these osmio-platinum plates are designed to play a part in some such new 'revelation'?"

"Your surmise would be correct," replied Gladwright, regarding me attentively and, as I could but feel, to note the effect which the idea of it would produce.

"Indeed! Pardon me — well, but how would you accomplish it?" I inquired. "I should imagine it might prove difficult. Mankind, although often absurdly gullible, is quite as often absurdly suspicious. I should certainly like to hear how you would put your revelation forward, how you would place it, so to speak, on the faith market."

"As to that, many plans have presented themselves. The spheroid, battered, dinted, corroded, calcined by fire, might be dredged up from the sea, or dug out of the ground, or found amidst the detritus of some rocky mountain torrent, — as if it had been shot to the earth from afar and fallen haphazard, centuries ago."

"I see; a kind of Copper Cylinder, Frozen Pirate, Found-in-an-Iceberg, Book of Mormon business. But has n't that sort of thing been overdone a little, already?" I said.

"You speak as if the idea were *passé* on account of some modern uses made of it by romance-wrights. But in reality the idea is classic. The Palladium and the image of the Ephesian Diana are instances in ancient times. For four thousand years the concept has held its place in the minds of humanity, namely, that something in the way of a revelation, either a tangible substance or a supernatural voice in the ears of men, may come to the earth from a being or beings of a higher order, afar. There is a species of intuition that some such word, or *signum*, may come to mankind. For this very reason the idea is the best that can be embodied for the installation of a new doctrine."

"But — all the resources of science would be brought to bear on your spheroid, to determine its character," I observed. "Do you think it likely that anything earth-made, fabricated of any earthly material or metal, would not betray indications of its terrestrial origin under the analytic scrutiny of modern chemistry?"

"The universe, in its entirety, is all composed of the same matter, the same elements," Gladwright rejoined. "The spectrum lines prove that. Sun, planets and distant stars are all of the same virgin material. The presumption is strong that all other planets of space, distant systems as well as our own solar system, are composed much as the earth is composed. They have their water, their mixed oxygen and nitrogen gases, their iron, their copper, their rock masses. Nothing is more probable than that a given planet afar may contain platinum, iridium and osmium. Besides, I have formed an alloy of these metals such as does not, to my knowledge, exist elsewhere on the earth's surface."

"I am sure that your spheroid would encounter many doubting Thomases, even if exfodiated from the delta of the Indus, or belched from the throat of Etna. By the by, why don't you embed it in a mass of meteoric iron, and then, having made a summer voyage to the Esquimos, discover it set up as an object of veneration in the *kashga* of some Mahlemoot village, to the south of Cape Barrow in Alaska, for instance? The fact that the Esquimos were venerating it as something which had fallen from the heavens, would help you out famously in establishing that point, which is the first essential point of the scheme. You could shift the onus of all that to the Esquimos, and I surmise that the public would incline to accept the Esquimo version. Diamonds are now alleged to have been found in meteorites. You could set some of our Washington *savants*, at the Smithsonian, to saw the mass in two in quest of diamonds, when, presto! the spheroid would be discovered — which, of course, would astonish *you* as much as the rest of them!"

The spectacle presented by half a dozen Smithsonian Professors, with their thumbs in their waistcoats, in rapt contemplation of my visitor's new spheroidal revelation, amused me so much that I burst out laughing at my own vacuous fancies. In fact, I was projecting these platitudes to temporize, and nursing inward reservations. Next moment I perceived that my levity was scarcely courteous; my guest was not amused; but he passed it by.

"Yes," he replied, "I have even thought of that, along with a hundred other similar projects, localized for as many different places in the world. I think that I have something even better, even more likely to capture belief." He said this gravely; and I experienced a sense of discontent both with self and my guest.

Gladwright brightened immediately, however, and appeared to make an advance of something like fraternal feeling toward me.

"That idea of yours is as good as any other," he exclaimed. "I agree to it. Let us accept it. I will purchase or build a steam yacht in San Francisco, and will you not make the voyage north with me, ostensibly to study the longevity of the Esquimos with reference to an exclusively animal diet?"

It was now, assuredly, my own turn to look grave, with a vengeance.

"Thank you," said I, hastily, "both for your invitation to make a trip, which I should certainly enjoy, and for your confidence in this matter of your *invention*, if I may so term it. But, Mr. Gladwright, I am afraid this project is not one to be considered seriously. Do you really think it is?"

He regarded me fixedly and with an earnestness which was even more embarrassing than his previous overture; I could see, too, that he was a man wholly above any egotistic resentment of my declining, on the score of personal vanity. He at once divined my feeling and my mental attitude toward him; but waiving all such considerations, he went bravely to the point, as one who sees an issue unfortunately raised which must yet be met.

"Why not seriously considered?" he asked, with a humble candor.

"Mr. Gladwright, I don't see how I can enter on that!" I exclaimed, impulsively. "Let me answer simply, that I feel there are insuperable objections."

"I comprehend perfectly what you mean," he said slowly and flushed a deep red; flushed in a manner I never saw a man do before.

"You mean that you cannot and that I ought not seriously to consider it because it is an imposture; but because I have come to your laboratory and am your guest you will not say this, but flee the subject. You mean that such an imposture is wholly contrary to the modern scientific spirit which puts its faith in fact and truth alone, the naked, unassisted truth; you mean that no truly scientific man would or should touch such a deception, or have anything to do with it; and you mean further that such a project is in bad taste as well as reprehensible from a moral point of view."

"This is your own characterization, Mr. Gladwright, pardon me," I said.

"But your point of view," he insisted, "your opinion of it, virtually, and rightfully, too, from your point of view. At first I held the same opinion and for a long time, a full year."

"A golden year of your life, Mr. Gladwright," I could not resist adding, since the matter had gone so far between us.

"No; not so. I am a better, a more moral man now than I was then," he exclaimed with conviction. "For then, I thought only of myself and the psychic effects of such an imposture upon my own mind, my own self. To embark in this imposture will be moral degredation for me, I reasoned. I must not do it. I shrank from it. But can you not see that this was merely selfishness? I did not wish to sacrifice my own precious self, nor get a speck of dirt on my own spotless moral raiment. I wanted to keep myself pure and unadulterated by evil. Then there came a time when I rose superior to this egoism, when I renounced self and even my own moral life, and said that to disseminate these great truths and thus accelerate the progress of humanity, I would even take the slow poison of moral hebetude and die, suicide, so be that a grand truth were advanced into the light. This determination exalted my moral nature instead of degrading it. I felt it the moment I determined to die, morally, for truth's sake. I had made a sacrifice of self, and — as always happens, I suppose — I experienced the compensating moral exaltation. You follow my thought?"

"Undoubtedly, but only to dissent, I fear," I replied.

"On the contrary, you dissent only because the form and extent of the self-sacrifice is new to you. You commend the college settlement man when he goes to live in a slum, although his brain and even his moral nature is necessarily polluted by the scenes of vice which enter his eye and are unavoidably pictured in the sentient substance of his cerebrum. We all, from our contact with the world, deteriorate morally; but shall we hold aloof and turn hermits? That idea went out with the monasteries. Not only our bodies but our 'souls' — I mean our intellects, of course — are to be used ungrudgingly, to promote human progress. I repeat, that you dissent simply because you are not familiar with this conception of self-sacrifice."

"I don't believe in it," I said, dogmaticly. "I think you have allowed yourself to enter a dreary path downward to self-abnegation, of unmanly self-surrender, which nobody is called upon to make, or would serve any really useful purpose in making."

"Yet I know to the contrary," he replied, gently. "I know it from the sense of rest, peace and self-approval that has rested like a divine benediction on all my thoughts since I took this lower step of self-sacrifice, since I said, under the stars, I will blot myself out and be effaced from existence that a grand truth may be the sooner and more forcibly enunciated among men."

"You take strange grounds!" I exclaimed. "These are sentiments for the *dii immortales*, perhaps, but not for mortal men." The reply was irrelevant, as I knew; but I was unable for the moment to express my real feeling. The attenuation of the moral motive seemed to me morbid; it exasperated me.

"But returning to the subject of the spheroid," I continued, in some heat and impatience. "The chances of its success, as an imposture, are slight. Ten to one, the truth would come out, either at once by some oversight or fault of your scheme, or as time passed, and cover you with obloquy. It would be a desperate risk on your part."

"I have considered these chances," Gladwright said, indifferently, his thoughts apparently remote from what I was saying.

"And what good would it really do, even if not detected and exposed as a trick on your part," I went on, "even if it were believed by many or by the majority of people to be a message from Mars or some planet of a mere distant world system? Would it be much heeded, think you?"

"It could be made the corner-stone of a new cult, a new religion!" exclaimed Gladwright with conviction. "It is thus that all the great religious movements of the world have started forth from some event thought to be miraculous, like the God-dictated law of Moses, or from some personage believed to be divine, like Jesus, Mohammed or Buddha; all, every one, found on a supposed supernatural authorization. The voice of man, any one man alone, even the voice of science, is not sufficient to inspire faith and move the great masses of mankind to believe with conviction and really change the currents of their lives. There must be some picturesque event, some word from above, some message from the skies. It is of the nature of humanity to demand some such authorization and origin for its faith. And why should evolution, the new grand truths of evolution, not have their era, their hegira, their popular point of departure? Do not, I implore you, regard me as a mere vulgar swindler of the public confidence. For the spheroid or the deception *per se*, I care nothing; rather I might regret it; but I make use of it as a means requisite to enforce faith in truth; a truth for which I believe the world to be ripe. Did not Moses tell the Beni-Israel that the tablets were God-written? Did not Jesus have resort to miracles? Did not Mohammed profess to bring tidings from the Moslem paradise and the Moslem Gehenna? Why? Because they were necessary to inspire faith and lift men upward to higher planes of life. Did not the end attained justify these expedients which the modern scientist would term impostures?

"Something that can be touched, seen, handled and set up before the public, some effigy, or simulacrum, is as necessary now as in past days, to strike the attention, to appeal to the imagination and to the love of the marvellous which still exists in the hearts of men as strong as in earliest times.

"This, believe me, is the true purpose of my device. You will see that I have selected the Greek characters quite as they were inscribed on the Hellenic temples, and quite as if deciphered from afar, by the aid of instruments of high telescopic power, in the hands of inhabitants of other worlds. In a word, I have made the message delivered conform to a modern practical conception of consistency. I have given it both a historic and a scientific verisimilitude. But its purpose is to serve as a starting-point merely, a nucleus of public interest and attention. As for the moral turpitude of the idea, on my head let it rest."

Of the earnestness and the impassioned spirit of my singular visitor, I can pretend to convey but an inadequate picture. Nor can I recall all, nor a moiety, of the arguments which he brought forward from history and from philosophy that afternoon. Sometimes he sat before me, his hands grasping the oak arms of the chair, his mobile, handsome face aflame with ardor. Sometimes he walked rapidly up and down, scarcely touching the floor with his cane, wheeling suddenly and to enforce some point that occurred swiftly to his acute, introspective mind. He seemed utterly self-forgetful and possessed by an idea, transfigured by it.

And I, listening, — for I had ceased to reply or contend, — thought of the epilepsy of Mohammed, the re-births of the Bodhisatta, and the general, universal, transformative power resident in ideas, good, bad and indifferent, and all above a constant undertow of uneasy misgivings, why this Anglo-American Yoghi had come to me, and what, in the courtesy due to a person of his high attainments, I could do or say at the end of all his oratory.

A young man of high intellect and exalted motives, capable of all self-sacrifice in the cause of truth, but gone wrong in mid-flight from some obscession in his later cerebration: such was my inventory of him.

Yet who could say that this was not that kind of epochal man who has periodically revolutionized humanity, a question only to be answered by the success or failure of his spheroid.

Moreover, he was a human torrent; the kind of man who in his simple earnestness has always captured and swayed the multitude; a born preacher and standard-bearer. It was simply impossible to listen and not sympathize, dissent as one might. From my first sight of the man I had expected something like this strengh of appeal to the great sub-conscious strata of one's mind, but he transcended my expectation. His energy and earnestness beset me sorely, and at the end of his contention, I felt hunted, in toils, and at bay of him. This was purely personal equation, for his spheroid now looked to me little better than a crime in embryo; but the man had laid hold of me by sheer strength of his purpose.

All the while I felt that I ought to take the upper hand with him and, by dint of what should be anybody's argument, throttle the temptation to which he had succumbed, strangle it, free him from the spell of it, and set the whole coil morally straight.

But all that I said was, "Let's sleep on this, Mr. Gladwright. Meantime, let me take you out for a sail on our lake. To-morrow morning I will tell you what I think of this."

But when morning came, my moral sky was heavy and negative. Instead of treating my visitor to the ethical disquisition I had intended, I merely said to him, "Mr. Gladwright, I do not think that I can enter further on this topic."

He turned away and stood at the window for a full minute. I think that he was disappointed, but mainly, probably, from lack of sympathy which he had expected from me. Be that as it may, he evinced no trace of resentment or wounded *amour propre*. He faced about after a few moments and grasped my hand cordially, with a charm of manner which I had noted in him from the first.

"In that case," he said, "you must try to forgive my importunity of yesterday.

"I had hoped," he continued, ingenuously, with entire frankness, "that you would be able to take my view and act with me; but if that cannot be, I will not revert to the subject again. I coveted your co-operation, and in the hope of gaining it, took you into my confidence in the matter of my trinket in platinum yonder, but of course I scarcely need ask you to regard the matter as between us alone. As I said, only yourself *and one other* know of its existence, or of my hopes concerning it. If you please, I will stay a couple of days longer with you here," he added.

"I was about to ask you to remain the entire week," I said, "and go with me to call on two or three centenarians who chance to reside within a radius of ten miles of this laboratory"; and thus the subject of the spheroid passed from mention if not from thought. Indeed, I was thinking, and the thought often reverted, whether if I should subsequently hear of a debated communication from other worlds, in the form of a bolus of platinum, I could consistently regard what I had learned concerning it as "between us alone" or not. In fact, I was afraid not.

Nothing further passed between us on the subject, however, although Gladwright remained until the following Monday. He was a charming guest, a Poe-at-his-best man. We sailed, rowed, and visited centenarians together; and I recall a remark of his apropos the yellowed, shriveled arm of one of these ancients. "There is something in the flesh of a person one hundred years of age that fills me with awe," he said, and added, "'Can a man in his flesh see God?' I say, yes."

In rowing or walking I had noticed that he tired quickly, betraying a kind of breathlessness, which I thought a bad symptom, and asked him one day whether his lungs were right.

"Not wholly strong," he replied. "Not diseased, I believe, but constitutionally inadequate for deep breathing. So several physicians have told me. My own idea is that the difficulty is in the pneumogastric nerve. I sometimes feel a curious numbness of that long nerve trunk, as I fancy, and also of the nerve trunks of my right arm and leg. But it is a small matter, I imagine," he added, with a laugh.

On the morning he left me I accompanied him to the station, sorry to part with him as a guest. As he took my hand when about to enter the car, he held it for a moment and bent one brief final glance of interrogation upon me, in mute challenge of my previous decision. I shook my head, and we parted.

## II.

### "AND ONE OTHER."

Of Gladwright I saw nothing more for a year and a half, nor heard of him, for we did not correspond, till the winter of '93. Then by invitation I was in New York to be present at one of those punitive electrical experiments which the Empire State conducts at irregular intervals within the walls of its suppliciary institution at Sing Sing.

An acquaintance invited me to go home with him over night, to one of those cozy New Jersey winter resorts, so convenient to the metropolis, at a quiet old hotel, patronized mainly by elderly New Yorkers of conservative tastes, who enjoy the wood fires and homely table. The house has a kind of combination drawing-room and writing-room; and I was sitting at a table here rather busy with the facts of a report which I was making of the above-mentioned experiment, my friend and host having gone to town by an earlier train, when a bell-boy brought me a card and said there was an old gentleman and a lady who would like to speak with me.

Turning, I saw them entering at the far end of the room; a large-framed, heavy old man, with abundant long white hair, which fell in an ocean-billow down a Turkish morning robe, and a beard even more profuse; in short, the head of a Bryant at eighty, exaggerated in every feature. A vast, smooth, white cascade of mustache blended, yellow as a spring torrent at the corners of the mouth, with the great volume of his beard. Quite a giant of an old man, viking, or Jovian of aspect, or as Jove might now look, Rip Van Winkle-ed and forgotten at his country seat.

Not a mild old man, but an old man with a history far behind him, a history of contention where opponents had bitten the dust which, relentless at heart still, he would make them bite again; a formidable and still terrible old man.

With great, bony right hand he placed a thick buckthorn cane slowly, with elephantine care and firmness, on the carpet. At his left arm, aiding him, walked a lady who was the old man rejuvenated and made feminine in a daughter. Contrasted with his grand bulk and Cato-like senility, she looked very feminine indeed and youthful.

"Them's them," the bell-boy whispered, and I went forward, glancing at the card as I did so, which bore the name of *Dr. Melamet Lincoast*, and had beneath in pencil, *Miss Edwina Lincoast.*

They noted my approach, but the daughter continued to conduct her father to a large chair near the bay window, observing which I made haste to place another seat for her convenience near it and fetch a chair for myself.

"We should have availed ourselves of the kind offices of your friend, Mr. Cushman, to become known to you less informally," Miss Lincoast then remarked, "but he is an early riser and leaves the house before our breakfast hour. I am sure that you will pardon the informality however, when I tell you that our object in thus seeking your acquaintance concerns one whom you have known and must remember — Mr. Lafayette Gladwright."

"Ah!" I exclaimed, in some surprise. "Mr. Gladwright was my guest some time ago. Has he — is he well? His health seemed not very firm," I added, feeling that I was entering on a subject that could not be followed far.

"Far from well. Very ill, I should think," replied Miss Lincoast. "He went to Colorado in June last, but is now at Los Angeles, with the intention, however, of returning to Colorado Springs next May or June, I believe."

"The chest trouble developed then," I said.

"Yet his doctors tell him that his lungs are not endangered; a little dullness at the left apex merely," replied Miss Lincoast. "But he seems to me very ill. I do not believe he will live a year."

As she spoke, I was thinking, "How will this invalidism affect the spheroid?" and "is this lady the 'one other?'"

Something of this curiosity was probably in the glance of suddenly greater interest with which I regarded her, a glance she seemed at once to comprehend.

"I knew the object of Mr. Gladwright's journey to see you in Maine," she continued, in a steady, evenly modulated voice designed, I thought, to express no personal opinion of the matter. "I am conversant with all the details of his strange scheme, if we may call it strange; it would certainly appear strange to most persons. I was his confidant from the first."

I could but look at her curiously, there was so much I but illy understood, so much I disliked to recall. There, too, sat the venerable giant, her father; and my eyes sought his face.

"My father is very deaf!" Miss Lincoast then said. "He does not hear a word of our conversation. He knows nothing of this matter; never knew aught of it. Let me confess at once that the motive for seeking an interview with you is wholly mine, and concerns Mr. Gladwright and myself alone.

"I perhaps counted too much on your intuition, too much on what you would take for granted," she continued, hastily, with a slight accession of color. "That is sometimes a woman's error. I see that to make this wholly plain to you, I must needs say that I was and am Mr. Gladwright's *fiancé;* and that but for his ill health and this other matter which has so possessed his interest, I should have been his wife three years ago."

"Ah!" I cried.

"Yes; it is plainer now," she observed, with a smile in which not a little irony dwelt. "Pardon my previous indirectness. I hoped, perhaps, that I might not have to be entirely explicit; but now at least we are on a basis of fact. Let me add that Mr. Gladwright is more possessed by the idea embodied in that anomalous globe of platinum than ever, if possible, and that even in his present state of health he is transporting it about with him, from one health resort to another, and with I know not what heroic projects fomenting in his brain, for setting it before the eyes of the world.

"Perhaps," she continued, with a sudden drooping of her calm, light-gray eyes, and a barely perceptible quiver of lip and voice, "you can now divine something of my anxiety for him, bound here as I am by every filial tie to care for my father whose life draws to its close, and with Mr. Gladwright, far away and ill unto death as I feel convinced, but still possessed by that idea, an idea both pious and impious, which may at any moment go wrong and disgrace him. You will understand, too, how much I might wish to speak with you, when I learned that you were here, since we are the two persons who alone know, or can be permitted to know anything of all this."

"Mr. Gladwright's project is wholly erratic, unscientific," I exclaimed, in a burst of impatience with him. "He should be brought to abandon it. Did you, have you never used your influence with him to set him right on that point?"

"At first, yes," Miss Lincoast replied. "At least, it seemed an erratic idea to me at first. I recollect that I thought it an immoral and wicked project. Afterwards, I was not so sure. I came to doubt almost whether it might not be an heroically sublime idea. You must yourself have felt Mr. Gladwright's earnestness and discerned the grand sincerity of purpose which actuates him. He does not at all take the common view of it, the view which you and I took. He regards the spheroid merely as an unavoidable concession to the weakness of human nature, its ignorance, its craving for thaumaturgics and novelty."

"He is quite off his head in this matter. He went wrong in his mind from the very moment he allowed the idea of such an imposture to lodge and take root in his brain," I exclaimed, Pharisaically. "There is but one way to keep right in the world, and that is to exclude rigidly all crooked ideas of that description, from the instant of their inception."

"I have heard it said so," replied Miss Lincoast, with so soft an intonation of sarcasm that I felt myself flush under it.

"But what can one say?" I rejoined. "This is an abnormality. You should tell him so and appeal to him as his betrothed to drop it. It is a cankerous, unhealthy project, and will kill him. I have no doubt that it is largely a factor of his ill health."

"I think so," she replied, indifferently, as if the thought were a threadbare one with her.

"This is mainly why I wished to consult with you," she added; "to see whether you could not aid me by some suggestion. I secretly hoped, when he went to see you in Maine, that you would disillusion him, and as you say, 'set him right.' Did you at that time speak your mind plainly to him, and give him your opinion honestly and frankly, as you have spoken it to me?"

"I dissented and declined to have anything to do with it," I replied, more faintly than I wished to answer.

"You dissented and declined mainly on personal grounds, I understood," said Miss Lincoast, with a sudden flash of resentment in her eye.

"Was it for me to preach a moral homily to a man who was my guest?" I remonstrated.

"Yes; it was for you," replied Miss Lincoast, with an accent of conviction which nonplussed me. "From no one could it have come better. More, it was your duty, one which you shirked, not because you so greatly cared for Lafayette's feelings — I know that from what he told me of his interview with you, — but because on that next morning you did not care to go into the matter again. You let the one chance slip of possibly 'setting him right,' as you state it, let it slip from mere disinclination, as I conjecture. And yet you were the person of all others really responsible for the spheroid."

"I am sure I do not follow you aright!" I exclaimed. "How responsible?"

"Lafayette would never have conceived the idea, never have thought of it but for a published paper of yours in 1889, which he read. Up to that time he was merely a great-hearted, impressionable, purposeful youth. I knew him well, had known him intimately since he was a boy of ten. I was at school with him and, later, his fellow-student at the Royal Institution in London, for two years. Lafayette was a favorite pupil of Prof. Huxley. I positively know that he never thought of this globe of platinum, nor of any of your peculiar theories of life, right or wrong, till he read your monograph in the winter of 1889. The idea that the evolution of human life on the earth is to be crowned by the achievement of immortal life took hold of his fancy. He talked of it constantly. He discussed it with me for days at a time, in all its bearings and aspects. It was in March of that year, that the idea of embodying the doctrine as a modern revelation, thus making it the corner-stone of a new scientific religion, first occurred to him. It presented itself but half seriously at first. I recollect that we discussed it, jocosely. After a time he became silent and reserved on the subject, for a year or more. Then one day he took me to a work-room at his home and showed me that curious globe of platinum. He explained the Greek inscriptions on the plates. At first, I was frightened. Afterwards,— but this is why I say that you, of all others, are responsible. It grew out of your ideas."

"This is conspicuously unjust!" I cried. "No published paper of mine ever broached or hinted at such a vagary!"

"I maintain that Lafayette's project came out of your published theories," iterated Miss Lincoast, in a tone of steady insistence.

"As well hold Franklin's kite experiment responsible for electrocutions at Sing Sing!" I said. "It was a perversion I could never have dreamed of and with which I cannot justly be connected."

Without deigning a reply, Miss Lincoast went to the window and stood there for some moments looking out in silence, to control the emotion which her mention of the former happier days of her companionship with Gladwright had caused her.

I understood now the searching glance of something more than mere curiosity which she had bent on me when I first went forward to meet them. It was something akin to animosity; and from her point of view I could see why she might detest me as a disturber of her life.

"We have certainly been very frank with each other for acquaintances of an hour," Miss Lincoast at length remarked, turning from the window with an attempt at friendliness.

"We have," I said; "and now I will tell you what I shall do. I am going direct to Los Angeles and have another interview with Mr. Gladwright. If, as you accuse me, I shirked my duty before, I will not shirk it this time, either out of courtesy or 'disinclination.' Of that you may rest assured. You may even believe me capable — other means failing — of capturing the spheroid, ***intra dies***, and fetching it East with me; Mr. Gladwright shall give it up. He shall quit *spheroiding* and go mountaineering with John Muir. He shall get well and become able to redeem every manly pledge which he ever made to woman or man."

I said this with such vehemence that even the deaf old doctor started and fixed me with two deep-sunken eyes, like those of some infirm old lion whom an unusual noise has roused for a moment in his cage. His daughter noted this and smiled as she put out a caressing hand to his arm.

"You mean what you say I can see," she said, with a face that had brightened as I spoke. "Do it. Seriously, it is worth your while. His life, his reputation, may yet be saved."

She made a sign to her father who rose heavily and they left the room together, as they had entered it.

"It is a sacrifice of three weeks' time," I thought, soberly. "But I will go and make an end of that infernal spheroid, by fair means or foul."

While I pondered my resolution, Miss Lincoast suddenly re-entered the writing-room.

"On reflection," she said, "defer setting off till you hear from me. Not relinquish, but defer. A week, may be; perhaps a month; possibly more; but I hope not. I hope, indeed, to arm you with still further arguments with Mr. Gladwright."

"Very well," I said, not entirely pleased; for when one takes an impetuous resolution, any impairment of it, or even delay, is for the moment irksome.

## III.

### COLORADO.

My intended journey, therefore, remained subject to call, or rather to a lady's permission; and I did not hear from Miss Lincoast that month, nor in February or March. Some message from her might have miscarried, I sometimes thought, for I was here and there in New England; and an idea of writing to make sure occurred to me fitfully amidst the daily hurry of many small affairs. I did not write, however; and my interest in the matter fell off imperceptibly from inattention and interposing occurrences.

Then, one afternoon toward the end of May, a telegram which had followed me from home to Philadelphia came to hand from Miss Lincoast, sent from Manitou, Colo., the day before.

"Mr. Gladwright is very ill here. Please come at once.
"Edwina Lincoast."

"So she is with him," I thought. "If very ill, the spheroid must be in abeyance. Then why send for me?" In fact, it was for the time exceedingly inconvenient for me to set off, for on the very next day I was to have opportunity to witness the effects of forced draught on the lungs of stokers, in the fire-room of a new steamship.

I set off that evening, however, on one of the fast "Pennsylvania" expresses, via Chicago, sending a telegram ahead to say when I would reach Manitou, three days later.

I thought it possible that Miss Lincoast might come down to Colorado Springs to meet me, for the branch line up to Manitou; and in point of fact, she was about the first person whom I saw on the station platform at the Springs. She had lost flesh and gained brown as if from wind and sun, but was quite as handsome as when I saw her in New Jersey, in the winter. Her stature and abundant light hair, brushed upward and backward off her forehead like a sheaf of Dalecarline flax, made her one not easily overlooked, even in the bustle of a railway station. An air of preoccupation and long-existent anxiety was about her, however.

"Then Mr. Gladwright is even worse?" I said, as we went to the Manitou cars.

"Alas! yes," she replied, hopelessly. "I was quite wrong. I blundered sadly last winter. I wish now that you had gone at once, as you proposed that day. But I had a wish to go, too; I thought that I might add my appeal to yours, and, pardon me — such was my foolish conceit — I thought that I might perhaps prepare his sensitive mind a little in advance for the more vigorous arguments which I saw you would make use of with him. Such was my vanity; I wanted to have my woman's hand in the affair. But there was my father who could not make a winter journey. I selfishly planned to delay it all till I could bring my father to Colorado in the spring, when Lafayette came back here. That is what I have done. We were delayed, however, and could not come till May; but Lafayette came in April and established himself up as Manitou, instead of at the Springs, for a reason which you will come to understand. But father is at a hotel here at the Springs, and I flit back and forth between the two places every day, sometimes by rail, sometimes driving. But it is all too late," she added. "I am properly punished for my scheming."

"Too late?" I said. "What has Gladwright done? Is he wholly laid up? Has his lung trouble developed so rapidly?"

"Oh, not his lungs at all. I have n't told you. It is paralysis. He lies helpless."

"Paralysis!" I said, in some surprise. "At his age?" — and then I thought of what Gladwright had told me of his physical sensations nearly two years before.

"Yes, complete paralysis of the right side with aphasia. He cannot articulate; but he can write with his left hand and covers whole tabs of paper in pencil to me. His mind is active, too active, and he remembers well; yet I can see that something is missing from his intellect."

"Naturally," I said. "A man cannot lose one half his brain without suffering personal diminution, even although he may appear rational to strangers. An intimate friend will miss something in him. The left half of the cerebrum is often insentient in such cases. But what about that spheroid, Miss Lincoast?"

She remained silent as if still intent on the former subject, and glanced out of the car window at the bare, green herdlands as the little train sped toward Manitou. I did not repeat the question.

At length Miss Lincoast turned toward me, her face wearing a singular expression, deprecatory, defiant.

" That is the worst part of it," she said slowly. " He had worked on that globe all winter, coating it, or covering it, or putting a casting of iron about it, to make it resemble a fragment of an aerolite.

"And that was your idea," she exclaimed suddenly, fixing me with that former glance of resentment.

" Great heavens ! " I groaned. " It was a word spoken in merest jest !

"And he said that he had thought of it before," I then recollected to add.

" I think that Lafayette did say that he had once thought of it," Miss Lincoast admitted.

" Pray go on. What has he done with it? " I exclaimed.

" He has carried that and several other *quasi* fragments far up the mountain."

" Up Pike's Peak? "

" Yes; up the mountain road. It is a road one can drive on. He drove a part of the way, he tells me. This happened a fortnight before I came. He made half a dozen trips, taking a fragment wrapped in a grain sack each time. I think that he felt that a fatal termination of his malady was approaching; persons have such premonitions in paralysis, I am told. Something of this kind led him, I think, to hastily mature a plan for putting his cherished project in trim before his health finally failed."

" And this plan was to make it simulate an aerolite, or a meteorite, which had fallen on the mountain? " I asked.

" Yes; far up the mountain. Yes; as if it had fallen last November, when so many meteors are annually seen to enter the earth's atmosphere; as if this sphere had been projected from some other planet and become involved or entangled in the meteoric ring or belt which, astronomers say, the earth passes through in November and in August. He had recast the plates inside the globe and replaced the Greek inscriptions with Chaldee hieroglyphics which, he says, are now sufficiently well understood to be deciphered. He spent the entire winter in the study of these Babylonish characters and in work on the plates. I think that he made haste toward the last; and from what he writes at times, I think that this plan of the meteorite was not what he would have adopted, not what he at one time had in view, but that he had recourse to it in his inability to carry out a former plan to which he has several times made reference inadvertently. But he is really not quite right in his mind now on all points; and his memory of recent occurrences is oddly disordered."

"He must have had aid to carry the spheroid up the mountain," I remarked. "Whom, suppose, did he employ, or take into his confidence?"

"No one, I am sure," replied Miss Lincoast.

"But the spheroid, encysted in its irregular iron matrix, must weigh from two to three hundred pounds," I objected. "In his weakened condition is it possible that he could lift it?"

"I am sure that he did so alone. He wrote that he carried it himself from the buggy in which he drove as far as he could up the road mentioned, to the crags where he finally left it; that and four or five other jagged pieces of meteoric iron. He spent many thousands of dollars in procuring a fallen aerolite from the peninsula of Lower California. It was a large mass. This furnished the material. He had a private laboratory at Los Angeles, and leased a powerful current of electricity, for smelting or welding, from the town light plant."

"Ah, well, we shall probably be able to find it," said I, with a sigh of relief. "If no one saw him put it there, we can easily manage the matter, to suppress it."

"But Lafayette has given me quite explicit directions for finding it," Miss Lincoast observed.

"Directions for finding it!" I exclaimed. "Does he want *you* to find it?"

"I have promised to find it."

"I do not understand."

Miss Lincoast flushed and bent her eyes on the deep-hued boulders of the Garden of the Gods, which we were then passing at a little distance on our right.

"I only promised him this yesterday," she said at length; "promised it finally in response to his entreaties. You have no idea how pathetic his case is, how greatly it appeals to me. This project seems to be his life. It possesses him utterly. It is of the nature of a fixed idea, more than ever so since his prostration and partial mental abatement. He wrote constantly of it all the time I was with him. It was simply impossible to resist the mute appeal of his eyes, when his poor tongue was so sadly silent. I may as well tell you all; I promised to find it on the mountain, and publish the fact of my finding it here at Colorado Springs, allowing it to be seen publicly.

Afterwards I promised to take it East with me and saw into it, under pretext of curiosity, to see whether there were diamonds in it, till I strike the platinum globe. I am then, without removing the globe from the magnetic iron matrix, to send the entire fragment to the Smithsonian Institution. There my connection with it is to end. All that monstrous promise I made," Miss Lincoast exclaimed, in low tones, but with as tragic a gesture of her hand as I ever witnessed.

"Oh dear! that is very bad!" I exclaimed. "You have indeed made a rash promise."

"You would have done it, yourself," she rejoined. "Oh, it is easy to sit in a library or a laboratory and indite cold, scientific precepts for human hearts to practice. How easy, indeed! but when it comes to the practising, when these wretched human hearts are torn and thrilled with anguish, is it as easy, think you?"

"Very true; very likely; but Miss Lincoast, what will you do with your promise?"

"Keep it."

"Ah! . . . Well then, why did you send for me?"

"I had not promised this to Lafayette when I telegraphed you, or perhaps I should not have done so. But of course I could have sent a counter message to you *en route;* or I could have remained silent as to all this now you have come. But I would not. You may conjecture why."

"I am very dull."

"You sometimes are. But reflect. When I send this supposititious aerolite to the Smithsonian people, if they should believe it to be what Lafayette hopes they will believe it, namely, a communication from another world in space, *what will you do then?* Remember, you are under promise as well as I. You virtually promised him two years ago to regard the matter of the spheroid as confidential. *Now what will you do with your promise?*" She turned suddenly and regarded me exultingly. "Don't parry. I told you what I shall do with my promise," she continued, impetuously. "What will you do with yours?"

"Break it," said I.

"I expected as much."

"If it came to a question of the authenticity of a communication from Mars or any other world, I would not let an imposture be practised. Any promise, tacit or otherwise, which I might have made, binding me to such an immoral silence, I should break and deem it better broken than kept," I said.

"Certainly. I knew that was what you would say," rejoined Miss Lincoast. "That is the difference between us, the difference, perhaps, between man and woman. I will keep my pledge. You will break yours. I knew this. Perhaps that was why I telegraphed you, why I tell you of my promise."

"I see. My broken promise is to serve as a kind of overruling providence for yours kept. Thanks for my apotheosis. Or rather, I am the scape-goat, I should say, to bear the errors of my friends."

"And justly," Miss Lincoast interposed. "Lafayette was your disciple. So was I. Your belief suffices, perhaps, when one is in health and high hope, but when physical weakness and grief fall on, it is too stern a gospel. We need all our pleasant illusions then. I, for one, would rather keep them. I honestly wish that mine had never been dispelled."

"New truth is always duress to us," I said. "That comes unavoidably from its reformatory, progressive nature. None the less it is our duty to receive and assimilate it. That is the one way we can make progress real, — by self-sacrifice."

"Progress — truth!" exclaimed Miss Lincoast, impatiently. "What is this progress? Whither does it tend, and why? And what is truth? I believe that another puzzled heathen once asked the same question, long ago," she added, with a bitter smile. "Why not laugh at it all?"

"I shall certainly laugh many times hereafter when I think of the sophistry with which you have beguiled yourself," I remarked. "Excuse me; you found me dull, but has it not occurred to you that there is something queer in keeping the letter of a promise, but sending for one who you know will make that promise futile?"

But Miss Lincoast had put both hands to her ears. "I do not hear! I will not listen!" she cried. "I am at the ends of my morals. Keep your promise or not. It is nothing to me. I keep my promise and care for nothing further. I am but one cell in the great organism of humanity. I know not its origin or destiny. I was not consulted. I am the ruled cell, differentiated to a humble use that shall pass and be forgotten; but I can keep my own little self true to the promise my blind heart prompted, and not all the science of the ages shall prevent me."

She said that grandly and sprang to her feet, for the train was at the Manitou station.

"Will you go to see Mr. Gladwright now?" Miss Lincoast asked, as we left the car.

"I have come two thousand miles to see him," I replied; "but after what you have told me I doubt the advisability of my meeting him."

"I doubt, too. But do as you think best."

If I had pondered it longer I might not have gone; but because I had come so far with the purpose of seeing him, and had not had time fully to change that purpose, I went at once.

He was in a large front room on the second floor of a gayly painted wooden hotel near by, and sat bolstered high in bed, with a professional nurse sitting at a bay window within call. He was somewhat wasted in flesh from what I had seen him two years before; the dark curly hair had grown a little thinner on the top of his head, and the high, bulging dome of his forehead looked more predominant than ever under the tiny blue veinlets that now showed beneath the skin. There was a slight distortion of the facial muscles of the left side of the face, and the droop of the eyelid, incident to such an attack; yet in spite of it all the countenance was still a noble and a handsome one. On the silk bed cover close to his left hand lay a large tab of paper and an attached pencil.

Miss Lincoast had entered the room a few steps in advance of me to acquaint Gladwright of my coming. She had cast off her wrap and hat and knelt on the rug beside the bed on the far side, taking his hand with a glance of the warmest affection, transformed so wholly from what I had seen her in our scarcely friendly intercourse that the change quite took me by surprise. It was a revelation of her as a woman, which I had not even imagined before; a revelation of what she could be to a man whom she loved. A finer picture than they made thus, or a sadder, or a more pathetic, I can scarcely conceive of. It affected me greatly.

The still mobile part of Gladwright's face manifestly brightened as I entered. It seemed quite as if he would speak; his stricken silence was strange; but he extended his left hand to me, which I took and sat on the side of the bed, much moved, but seeking to make my greeting cheery. "Ah, Gladwright! How's this? Heard you were under the weather a little. Thought I would run up here and see you!" etc., the things we say at such times. He dropped my hand, and seizing the pencil, wrote eagerly, —

"How are you! Awfully glad to see you again! It's right good of you to come! Yes; I'm laid out — decubitus — *gastados*. You recollect what I told you about myself, my nerves, that day in Maine, the day we went to see old Miss Rice in her hundred and first year. Well, it has come; I knew it would come; but it came a little sooner than I expected. Caught me napping after all, with my work not done." He turned his face for a moment, as he wrote, toward Miss Lincoast, who still kneeling held his cold helpless right hand in hers. "So I am out of it. Seems rather strange to realize that. But I'm out of it for good. Only thirty-one, too. Quite ridiculous to go out at that age. Always used myself well. But it is largely the outfit we get from ancestry, is n't it? Our ancestry is a lottery and I drew a short lot."

"Oh! we will soon have you on your feet again," I said. "With electricity, massage and good nursing, we make short work of a seizure of this sort nowadays. Lots of young men have attacks of this sort. It is all along of our mode of life in America. We run heavy on our nerves; but good treatment and an easy time afterwards make it possible to reach a good old age in spite of a break-down of this kind."

Gladwright smiled, a strange, unilateral smile, and shook my hand again as if to thank me for my cheerful words. Then he wrote, —

"What about yourself? How is the great inquiry progressing? What lines are you working on now? Tell me all about it. What are the latest aspects of it? What is Maupas doing this year? He is a most suggestive fellow."

It was Gladwright, but Gladwright with something wanting in volume, dignity and coherence. Miss Lincoast, who had now taken a chair on the other side, smiled when he turned to her, but ah! with what an ineffably sad, fond smile. We both felt that something of him was dead and gone. But we conversed thus for an hour or more. I told him whatever of biological news I had; and he wrote of his sojourn in California but did not allude to the spheroid, his gentlemanly instinct seeming still to withhold him from mentioning it, as a subject closed between us at the time we parted in Maine.

At length Miss Lincoast was obliged to take the train back to Colorado Springs, to her father; and, having resolved to remain for a few days, I sought accommodations in Manitou.

In the end, I remained a week; for I wished to see that a course of electrical treatment and massage, on an intelligent plan, was adopted. If other conditions remained favorable, I had hopes of hearing him speak again, and even faint hopes of seeing him on his feet. His worst symptom was an abnormal activity of the unaffected half of his brain, and some little insomnia not frequent in such cases, for which the local practitioner had prescribed sedatives. Many of the physicians at a health resort for pulmonary diseases are naturally lung specialists. Gladwright's doctor, a pushing young fellow, believed that he found evidences of phthisis in his patient. The case was a peculiar one, quite likely to mislead. The diagnosis made was phthisis complicated unusually by hemiplegia from clot in the left lobe of the brain, the latter the result of over-exertion and exposure during a long jaunt on the mountain; in short, a routine diagnosis, in which four fifths of our medical men would probably concur. Yet, from what I had seen and learned of Gladwright's ancestry, I believed that paresis, from a syphilitic taint three generations old, antedated the present attack; a constitutional malady which had run its incurable course so early in my friend's life; and, par parenthesis, I believed this disease largely responsible for the platinum spheroid.

It was this suspicion as to the ætiology of the malady that rendered all my hopes of alleviation by electrical treatment and massage faint at best. And although I said nothing of this to Gladwright, I suspected that he, too, privately held the same opinion of his own case; for he occasionally spoke of his doctor as "that amusing young fellow who calls on me"; and it is an unfortunate circumstance when the patient is irreverent of his doctor.

The aphasia in such cases usually lifts after a time; and, due either to the treatment or the normal reaction of the organism, I had the pleasure before the end of the week of hearing his tongue make clumsy efforts at speech

All three of us studiously took the gayer view and held ourselves to the lighter vein in our conversation. We laughed and joked over these efforts of Gladwright to talk, as if he were a child just learning to say "papa" and "mama," he leading off in it all.

"Now say, 'mama'!" Miss Lincoast would exclaim to him, kneeling by the bed and holding his hand with a laughable impersonation of the fond mother. Gladwright would force his thick tongue to wobble forth, "mom-mom," and then, in affected delight, would put out his other hand to her.

"Now say, papa," pointing across to me. "Plob-plob" was as near as he could come to that, at first. Hilarity is not difficult to foster. Our jocosity over these trifles was boundless, to the scandal of the nurse, a very proper person of the quite correct type. Of course it was but the scum-coat of light opera over a tragedy. When Miss Lincoast went to the cars, to go down to the Springs to her father, I once or twice caught a glimpse of her through the window, as the train went out, with her handkerchief pressed to her eyes, convulsed with sobbing.

"You are a lucky fellow, Gladwright," I said to him one evening after she had gone. "To be loved in that way by a woman like her is given to few men. From the very highest point of view, you are Gladwright, the Fortunate."

"Heaven knows I am," he wrote, much moved.

"And that's the worst part of it," he added hurriedly. "That she loves a miserable wreck like me, a victim of the sins of the fathers!"

"Nonsense," I said. "Get yourself together. Summon your *vires naturales* and pull out of this. You may have thirty happy years yet."

"And who knows what we may discover in the line of prolonging life in that time!" he rejoined on his tablet. "Why, we may not have to die at all, in thirty years!" But this was merely off a piece of our habitual hilarity that week; for after a minute or two he wrote more seriously, —

"I understand how you can say, 'Summon your powers,' because you have a grand surplus of powers stored away in your protoplasm. But I have n't them. At the heart of every nerve cell of my body there is the bacillus of an old dry rot. It is a case of powder-post. It is paresis as well as paralysis. Where you have power I have punk; and you cannot turn punk back to oak, can you? But you don't know how much I thank you for all this hope you try to give."

We sat with him every forenoon, and also again in the afternoon; and the jests we made were well-nigh incredible. Some of our laughter and fun was quite genuine, too; the simulated often drifted into the real. The theme which pleased Gladwright's fancy most was realistic description of what the world would be a few centuries hence, when great scientific discoveries and the progressive evolution of humanity shall have brought the earth to realize our present ideal of heaven. To humor his fancy we both allowed imagination to run to depictions of such a possible future of life on the earth. In this sort of prophecy Miss Lincoast evinced a remarkable gift. Some of her word pictures, as we sat there by Gladwright's bed, were really wonderful feats of fancy.

"And I shall be there," he would write on his tablet and show to me as she romanced on. "I may not know it, personally, but I shall be there. So will you. So will she, — though we may not know it. We shall be in it. We shall be part of it."

I really had some faint hopes that he would get on foot again.

"We will electrocute that bacillus with the Faradic current," I used to say to him; but on reflection since, I do not believe that Gladwright himself ever really had any hopes of recovery. We talked so much of it, however, that at length, out of his ever-abounding courtesy, he would not seem to gainsay us, but laughed and talked of it with the joyousness of a boy. On reflection, too, I should now say that Miss Lincoast never had any hopes, and because of that despair in her heart, she appeared to love him the more fondly.

The night before I left for the East, I spent most of the evening with Gladwright, Miss Lincoast having gone down to the Springs, as usual. He knew that I was going, in fact, had urged me to do so, knowing that I had many interests in hand; for the high tone of the man had suffered little abatement.

I told him that I should come back in September or October to see him, and hoped to find him much improved.

"I engage to be better or worse by that time," he wrote.

"I ought," he went on. "For I suppose you can see that this sort of thing is wearing Edwina out; one invalid at the Springs, another a Manitou, and two railway trips per day between them."

He turned his face away from me into the shadow; I saw it working pitiably in its deformity. But he mastered his emotion, unseen by me as he hoped, and presently resumed his pencil.

"I conclude that if ever there was a case where a man ought to avail himself of what thoughtful old Marcus Aurelius called 'the open door,' it is mine. All my instincts and even my conscience tell me so."

"Oh, now, none of that later Ingersollism for us!" I exclaimed. "Rather let us be good Brahmins and regard all life as sacred."

Gladwright smiled and lay silent for several minutes, then changed the subject.

"There is a request, a favor I am going to ask of you," he thereupon began to write again. "The first request I made, that one when we first met in Maine, you could not grant, you know. That subject I, of course, shall not open again. It is enough that you could not grant it and that I know you will respect the confidence I reposed in you regarding it. This second request is something quite different. It concerns Miss Lincoast, the dearest person in the world to me. I am honestly afraid that she will never form another attachment. I wish she might, but I fear that she will not. She is but one year younger than myself; we have been lovers all the way up from childhood. She is, as you see, a beautiful woman and even more remarkable in intellect than in person; and she has been educated to think deeply and fearlessly on all subjects. Like myself she is an only child; her mother died years ago, as did my parents; and the old Doctor will soon pass on. She will then be almost or quite alone in the world; and my apprehension is that she will be a very solitary woman as years go on.

"Now this is my request. However busy you may be as months and years pass, do not wholly lose sight of her. Misfortune may fall on her. Stand her friend. Remember, she and I were the first who really took interest in your work. True, we have now come to grief; but we did fully recognize the truth which you set forth and were among the very first to do so.

"You will have a busy life; I can see that; but promise me that you will not wholly lose sight of Edwina Lincoast, and that if she ever needs a friend you will stand by her."

"Indeed I will," I exclaimed, when I had read what he wrote. "Miss Lincoast and yourself will never be forgotten by me. I am not the person she would ever choose for a friend, that is to say, an intimate friend. She will always feel a certain antagonism toward me, I imagine. I will never forget this request of yours, however. Of that rest assured. I hope I may long enjoy the friendship of you both," I added.

And after some further talk of meeting them in September or October, I took his hand for a minute, as I sat on the bedside, then said good-night and good-by.

At the Springs next morning I saw Miss Lincoast but for a moment, at the railway station, as I changed cars. She consented to keep me informed at intervals as to Gladwright's health.

"And when I go in quest of aerolites," she added, as we shook hands at the car step, "I will send you a wire."

"Very well," I replied, in the same vein. "Perhaps I had better go with you."

"I should be very grateful for your company," she said. "It will be a mournful quest."

To be quite frank, I did not wish to have anything further to do with that bogy spheroid, and was sorry that the matter had been mentioned again.

It was the World's Fair year, as all remember, a summer of comings and goings; I was in Chicago at times, in New York, at home, and in August made an unexpected trip to Leipsic.

Once a fortnight, however, I received a formal letter from Miss Lincoast, often inclosing a cordial one from Gladwright. As I had expected, the aphasia largely lifted; and for a time Miss Lincoast's bulletins were encouraging. Gladwright could move the fingers and toes of his right extremities a little. He sat up constantly, and was attempting to stand up. The electrical treatment and massage were continued assiduously.

Then came less hopeful letters and allusions to fits of melancholia on the part of the hitherto cheery and great-hearted patient. The mid-August letter went astray and did not reach me in Berlin till Sept. 11, along with one written but fifteen days previously.

"Not quite as well," the last one ran; and on the very next day came two fateful words of cablegram: "Gladwright—dead."

Thus on this hurrying, heaving sea of matter illimitable, we find ourselves separated from friends, by many a league and wide degree, till in a moment the electric spark tells us that they have disappeared forever, like bubbles from its surface.

On returning home to America in October, a letter from Miss Lincoast, written a fortnight previously, put me in possession of the particulars of his death. He had perceptibly lost ground for several weeks, and changed his physician twice, also his nurse. Restlessness and melancholia had fallen on him; for several nights he had sent the nurse from the room. At four o'clock on the morning of Sept. 11, he was found dead and quite cold, with his hand on the tablet, where he had written irregularly and faintly in the night: "The last word to my darling Edwina—good-by."

His death was attributed to a "second shock" of paralysis; but there was evidence that he had taken an opiate; and I am more inclined to believe that dreading the supervention of mania, and unwilling longer to see Miss Lincoast the servant to his helplessness, he had by a fatal dose of the morphia sought "the open door" to which he had alluded on that last evening we were together, and voluntarily lapsed into the void from which by so long a travail of organic evolution we have but hardly arisen. His body had been sent home to Pennsylvania for interment.

By the same letter Miss Lincoast informed me that she had decided to take her father to Los Angeles during the approaching cold season. Her only allusion to the spheroid was in a marginal note, added apparently as an afterthought: "There is snow on the mountain."

## IV.

### THE AEROLITE.

During the winter I heard from Miss Lincoast and her father but once, although I wrote twice, and again, briefly, in March, to which no answer came till May, when Miss Lincoast wrote, saying that they were at Colorado Springs once more. Again she added a marginal word: "The snow is now entirely gone from the mountain."

By this time I had thought the matter of the spheroid over more leisurely. I felt afraid that some disagreeable imputation of attempted imposture might come to attach to all three of us. It seemed to me best to find it, if possible, and effectually put an end to such risks, for the future. I had come to regard it as the psychic aberration of a dead friend; in mining phrase, a "fault" of his cerebral strata. Two persons at least could contemplate it charitably, tenderly; none the less, it was a thing to be put summarily out of existence.

Still another misgiving was in my mind that day. All Colorado was then in a state of political and social ferment, concerning "silver" and "populism." A civil *emeute*, even, was among the possibilities there; and my thoughts reverted uneasily to the request which Gladwright had made, and my promise to him. That latter promise, at least, I could keep. I therefore telegraphed to Miss Lincoast that evening that I would come, and set off accordingly on the following afternoon.

It chanced that I arrived on the same day of May as that on which I had reached Colorado a year previously; and, as on that first visit, so now Miss Lincoast came to the station to greet me. She was standing outside the door of the waiting-room, as the train came in; and, as before, I saw her over the heads of a nearer group of girls, who were loyally and exuberantly greeting the victorious return of a local base-ball club. She looked a little older, or perhaps only a little more sedate and self-contained, or lacking the aspect of anxiety that was on her that day a year before; a little thinner, too, and quite as embrowned from riding in sun and April air, which made her abundant, pale hair appear even more profuse, and her face smaller, but fair and firm as ever — a norland Miriamne.

" I am indeed glad to see you," she said, " although I did not send the 'wire' as I said that I would. I had decided that I ought not to ask you to come."

" Ah, well, you must try to accustom yourself to see me come uninvited. You are my ward, you know. It 's the nature and habit of the guardian," I said, without much tact.

" Your ward ? " said Miss Lincoast, a little curiously and with a smile that expressed some slight perception of humor in the notion. " I fear that I am too old for the rôle. And I should have said that you were, well, not too young, but too idealistic, preoccupied."

" You were about to say incompetent. Don't trouble to search for euphemisms," I rejoined. " Frankness is our strong point, you know."

" No, I was going to say idealistic," Miss Lincoast insisted. " But that word signifies a great deal in the matter of guardians."

" It 's the trouble with guardians, the ward does 'nt have the choosing of them," I said. " I am your regular-appointed, however ; and you will have to temporize and tide along until such time as he who has a better right shall oust me and make me show all my crooked accounts."

I knew that I had blundered and said something inopportune, and now hurriedly inquired as to the health of the old Doctor.

Miss Lincoast replied to this and was silent as we went toward their hotel for some moments.

" Really, did Lafayette say something like that to you ? " she asked at length, in a low tone.

I told her then exactly what had passed between us, although I had no thoughts of doing so previously.

" Noble heart that he was," she said. " You don't know half the pathos of his dying, how he fought off that encroaching melancholia and that cruel irritation of mind, and kept always his cheery, chivalrous traits uppermost with me, till with one last despairing cry in the night, he left me and took his lonely way down into the Gloom."

I found that she liked to talk of Gladwright, but always in the same low, hopeless tone.

" The aridity of my mind frightens me sometimes," she said, in further conversation that evening. " I seem to feel nothing now. I have shed my tears, I fancy, and lost the capacity. Perhaps my original capacity for it was meagre. It is dreadful to feel that one is done with that. My mind is like these Colorado herdlands in a rainless season."

"The rain will come again," I said.

"Mine does not seem to be that kind of sky," she replied, continuing the simile on which we had inadvertently stumbled. "My sky is one of those cold gray ones which you have in the far northeast in December, stone-gray all around the horizon, when you say, 'It may snow, but it is too bleak and cold to rain again this fall.'"

"Your mind now turns in the weary mælstrom of a great sorrow, but at your age the natural reaction will come, if you keep your health; and you will drift out of these leaden-tinted waters," I said.

As I took leave a little later, Miss Lincoast remarked, "Perhaps I ought to tell you that I have already searched for the spheroid."

"Have you found it?"

"No; and I am afraid I cannot. I have been up the mountain four times. I followed the directions which Lafayette left me explicitly, as I thought. He made a little sketch-map on a sheet of note paper. I went by that; but I cannot come upon the place. I intended to find it before you came out," she added, frankly.

"And fulfil your promise?"

"Yes."

"That is not well," I said. "A friend should bear a friend's infirmities, ameliorate them, mitigate them and pass them tenderly by. But you would perpetuate Gladwright's one lapse from moral truth. Rather you should draw a veil over it and cover it from every stranger eye. Believe me, Miss Lincoast, that one lapse from moral integrity was not Gladwright, but the malign genius of that hereditary, incurable disease which has cut him off in his prime."

"Oh! Oh!" she cried, and as on a former occasion, put both hands to her ears, then quite inconsequent to a lost capacity for tears, wept uncontrolably. "That promise to him I can never break!" she cried stormily. "I have tried. I knew what you would say. I know it all. But I cannot. I will not.

"For how know I but that my falsehood might still give him pain?" she exclaimed. "Spite of all science and the greater probabilities, how know I but that his poor, pale self, or the shade of it, may not, conscious or semi-conscious, be still lingering, expectant and trusting me, in the dim caverns of the nether earth, or wandering by 'the dark and gloomy pools of Orcus,' in sad but patient waiting for the day when I shall come?"

"These are but the ***manes*** of old fables that have crept into your mind when worn and weak from grief. Forget them in a healthy night's rest," I said. "To-morrow we will both look for the *aerolite*."

But I hoped now that we might not find it and that no one else would ever find it; for with reluctance I began to be aware that, if found, some distasteful stratagem, of the nature of a pious fraud, might be necessary to give the spheroid its quietus; and I could scarcely conceive of a subject less suited to monkey-tricks.

From afar over the eastern plains the sun was flooding my chamber with its life-tides when I waked next morning. One of those glorious, air-light days of early summer in Colorado had dawned. My joy of it could scarcely be restrained by any thought of sorrow as we set off by train to Manitou, two hours later. Nor were the bright sunshine and fresh, crisp air without their effect on my companion, although to her such suns and airs were less of a novelty than to an Easterner like myself.

At Manitou we hired a double-seated wagon and horses, with a young stable-man to drive us up the mountain road, — the same driver whom Miss Lincoast had previously employed. As some explanation of her trips had been necessary, she had told him that she was searching for a meteor which she had reason to think had fallen on the mountain the previous autumn.

We toiled upward as far as Gladwright had driven; for his route was fairly indicated on the little sketch map which Miss Lincoast had preserved. His course after leaving the road could be less clearly demonstrated; there seemed to me to be an ambiguity in the dotted line which he had traced off to the left of the road, as the course which he had taken athwart the rough slope, leading to a craggy quarter of the mountain. He had specified the distance as "about half a mile" from the horse trail.

"But I have been carefully over the whole ground," Miss Lincoast said to me as we left the wagon. "I have quested over more than a square mile here, north and south, east and west, up and down the mountain side."

In point of fact, from some curious obliquity of mentation, after his hemiplegic seizure Gladwright had indicated his route, as sketched on his map, to the left instead of to the right of the horse trail, as was the fact. This of itself is an item of interest, perhaps, from a pathological or pathognomonic point of view. On his map the dotted line diverged to the left and we did not think of questioning its accuracy in so radical a particular.

It seemed to me well to go over the entire ground again and we did so, walking rapidly over and among the weathered gray ledges and rocks, for an hour or more. Gladwright had told Miss Lincoast that the semblance to meteoric iron had been perfectly preserved in the broken fragments which he had scattered at the foot of a high ledge of rocks, and that these fragments would be easily recognizable from their dark, reddish-brown color, in marked contrast with the gray mountain rocks.

"I have looked in vain thus far, however," Miss Lincoast added, after I had studied the map and tried to locate its points as indicated by the visible topography of the Peak side.

Again and again we referred to the paper sketch as we walked and climbed; and a sense of something bewildering in it constantly troubled me; but the bright day, the wide view to eastward, the exhilerating air and the wild surroundings were in themselves a source of constant delight.

We had brought a lunch and after a long scurry, returned to the wagon, then set off afresh, going this time resolutely still farther around toward the south side of the mountain, and questing for an hour or more amidst hoary, lichen-clad rocks. My companion's lighter mood of the morning had changed somewhat. The emotional effervescence of our spirits had waned, from muscular exertion and the advancing day.

After a time I recollect that we sat down to rest, and with the contemplative eyes of amateur mountaineers, let our gaze wander far out over the depressed eastward plains stretching away down the arid Arkansas bottoms.

"Settlers are toiling there in poverty and hardship," Miss Lincoast remarked at length. "But they have their temporal joys and always their hope ahead of something better to come, and at the end of it all they mostly hold a little, if not very much, of the faith in another life, where what they fail of here will somehow be found.

"I don't know that I believe in science telling them anything more of the real grim truth of nature than they know," she continued, absently.

"For the real truth is much too stern, even for the best of us who have wealth and everything thus far gained, invented and provided to hearten and console us. I wish I were a credulous child again. I believe that I would learn nothing but the Romish Catechism."

"And be a skulker in the great struggle of life's evolution?" I queried.

"Yes, a skulker. The grim truth of nature and life cows me and fills me with moments of panic when I can only flee ingloriously. I want to see a tree, a pope, a Bible, or something that I can crouch behind, when the bullet-truths of discovery come so thick. It is not that I don't know better. Thus to hide is dishonorable, I feel sure, but my heart lacks courage.

"I think that we must be at the hardest, most pathetic epoch of evolution," she said presently. "The epoch of the awakening from infancy to the age of accountability; of passing from the fairy tales of childhood to the plain prose of life as it is. Our bodies and much of our intellects are purely animal; but a higher brain has begun to develop in us and perceive the real situation."

"Then, for that very reason we have need to be heroic," I said. "It is our plain duty neither to skulk, nor malinger, nor relapse maudlin to these old fables of the world's childhood."

"But I sometimes have my doubts; I cannot help them. Will anything ever come of all the struggle after all?" my companion questioned. "Is it not a vain and misconceived evolution that somehow started erratic only to beat itself fruitlessly on the hard stones of earth, only, like a plant on a cold alpine peak, to cling by insufficient root and never bear its flower?

"I sometimes fancy that life came accidentally to earth from some better, milder, more life-fertile planet, and that it has been struggling on here ever since, all these eons, to death, struggling on to death rather than to life," Miss Lincoast continued, with far eyes and rapt, sibylline face. "A luckless, unfortunate evolution that ought never to have begun, since it can never eventuate in anything save pain and death, on a theatre so bleak."

"Schopenhauer and von Hartmann!" I exclaimed. "There is no real reason for that view. The evidences are that evolution, the evolution of brain, is proceeding steadily, favorably, hopefully."

"I suppose that we ought to believe so. But in the far end, what? After you have invented, wrought, made earth a perfect abode, a heaven, and achieved deathless life — what? The astronomers tell us that the earth, the whole solar system, tends to an end, —

"'As heat departs and earth doth colder grow,
And the bright sun's vast fires shall pale and smoulder low.'

"What then?

"'Be blown about the desert dust,
Or sealed within the iron hills.'"

"The astronomers really know little more about that than you or I!" I said, impatiently. "What will come millions of years hence may safely be left to the son of man to provide against!"

"I sometimes believe a little in a not wholly omnipotent Deity," Miss Lincoast continued, not hearing, or not noting my short-range wisdom. "For who can rationally believe in a wholly omnipotent one!" she suddenly exclaimed. "When we see how easily the miseries of life might be alleviated, and the horrible things that happen daily, who can believe that there is an omnipotent God! But I mean some being on some other sphere, who is able to do more than man can do and who is doing somewhat, the best he can, to assist us and who would do more if he could!"

"You will ultimately get back to your Catechism and your High Church," I said, laughing. "That is the fate of most ladies who set off as free-thinkers."

"Yes; we are like those hunters who get lost in the forest; we begin to travel in circles and come around to the same place," replied Miss Lincoast. "But even then the spot looks strange, they say. They hardly know the place. The old creed can never be really taken up again, once our child-faith in it is broken.

"No; I can never go back, but shall wander on and on, as poor dead Lafayette is perhaps now wandering in dim Orcus," she continued, mournfully. "The old creed that once seemed so fine has now all turned cheap and mean to me. For what did they give, all those vestured priests; what did they offer us to do and to have? With a great toil of devotion they gave us to climb the tottery bean-stalk of a Faith, only to find an angry Giant at top, ready to put us in his oven."

"There, there, that will do!" said I, laughing. "Come back to Pike's Peak and let's find this pseudo-aerolite which, when one thinks of it, is a stranger thing than even you have said or imagined to-day."

"It is," replied Miss Lincoast; "and for that very reason it rules me."

But her eyes still sought the far horizon.

"Through all this slow outgrowth and loss of the old child-faith, I have had the hope that I should come to something better, something nobler," she continued, reminiscently. "I gave up the old creed cheerfully, almost exultantly at times, glad to see it swept away. I know there is such a grand faith somewhere ahead of science. But strain my eyes as I will, I cannot yet discern the outlines of its consolation. I begin to think that I never shall; that my mind has n't capacity for the development required to discern that greater faith and to grasp it.

"Once I thought I saw it!" she resumed, impulsively. "I thought I saw. And for one whole week I was happy. I was more than happy; I was strong and seemed to be grounded on an eternal certainty. But it slowly faded and imperceptibly lost itself from my clutch; and once gone, my intellectual life seemed to slacken again."

"Can you not recall the general tenor of it, or the idea?" I asked.

"Oh, yes, in a prosy way; but I meant that the thrill of life that came to me with it has vanished and left me cold again."

"If it was a truth that thus appeared to you, it will recur," I said.

"And if it were an untruth?"

"Well, I am not so sure as to that. Errors revive in human minds as well as truths."

"I think that this will yet come back to me," Miss Lincoast rejoined. "It was — it was like this. The idea suddenly pictured itself, that we should make a future state after death for ourselves by our faith in it. But ah! how colorless and negative my words sound! It flashed to my mind that our self consciousness, our intellects are linked, or correlated, as the scientific writers say, with all the other modes of energy in nature, with heat, with light, with magnetism and electrical energy; that our minds and our wills act on and are the mechanical equivalents of these so-called natural forces. It then came to me with great vividness, that if this were so, then all humanity, by believing and *willing* it, might make a future life after death an actual fact, or sequence in nature. Do you in the least get my idea?"

"Partially; explain more fully."

"Why, it was all in that one conception, and I was n't able rightly to hold on to that. Only it was as plain as the sun to me for a few hours. It seemed to be a vision, an inspiration. It transformed all my hopes in a moment. I was a new being while it glowed in my mind. Oh, why did it fade?"

"Perhaps because it was an *ignis fatuus*, a mental will-o'-the-wisp."

"Oh, but I cannot believe that! It was so benign, so holy to feel!"

"Summon it back then. Invoke it with the authority of your need of it."

"I have n't the strength of purpose. My whole early education was perverse to truth, scattery, fragmentary. If I had been trained from a child under a fearless soul, like Prof. Huxley, I should have had the mental discipline and the orderly stores of knowledge for holding and grasping my new faith. Instead, I spent those priceless years from eleven to fifteen learning music, how to enter and leave a room, what to say or not to say in the presence of gentlemen — pah! as if nature did not teach us all that by intuition, ten times better than any lady superior's injunctions.

"Yes, I whiled away those years and only after I was twenty waked to a few glimpses of natural truth. And so it was but a glimpse that I could catch of that grand light, a ray of which fell into my mind through a chink of the wall of error by which I am built in."

"You are too diffuse. You mean that you had an idea that if all mankind would exercise full faith that we can live as disembodied 'souls,' after death, and would *will* it to be so, such a state, or future life, would exist from natural law, by the correlation of the forces of nature? You mean that by united faith and will power, mankind can call a future life into existence and maintain it in existence under the natural laws of the universe?"

"Yes, that is the barren statement of it; but it presented itself to me one sweet morning with a halo of beauty and emotion about its brows, and walked all day with me through the groves. What a day that was! You do not comprehend half the idea. Not only the faith and will of human beings go to create the future life, but all the lives, the life emanence of the animal and vegetable orders of terrestial life. My conception was that every life, plant or animal, is living to aid in creating that necessary 'atmosphere,' or state, which makes a future life, after death, possible and natural. Don't you begin to see? Don't the idea begin to take hold of you?"

"Faintly, perhaps."

"And what do you think?"

"Agnosco. What proofs can you adduce?"

"Proofs! I have n't looked for any — yet. Faith, you know, is something which takes us up and makes the necessary proofs as we need them. It makes what we desire to have made, physically possible. It realizes. What we desire to have after death, it makes for us by reciprocal correlation of the natural forces. It is creative; hence there is no need of proof. When you fully believe, you have it. What mankind fully believes it will make for itself. But oh, I weaken the idea by attempting to expatiate and enlarge upon it!"

"So I see."

"But you do discern something in it, don't you?"

"Oh, yes; enough to make a book of."

"Don't mock me."

"But you should pick this idea resolutely up and estimate it. Compare it with Prof. Joseph LeConte's theory of a soul ether, Dr. Elliot Coues's hypothesis of 'biogen,' very earnest Prof. Drummond's 'Ascent of Man,' and the similar theories of a dozen other recent writers who rear those beautiful half-way houses between 'Science' and 'Religion.' There is quite a distinguished company of them; and it is a lovely kind of architecture, a wonderfully alluring species of mental dissipation. And their books sell like hot cakes with all that great class of semi-emergents who want to be let down easy from the eider beds of their illusions to the hard bed-rock of natural truth. Develop your idea, Miss Lincoast; if you can but fetch disembodied soul life out of it, you will not lack for readers, and 'will prove a boon to thousands whose minds are unsettled by the,' etc., etc."

"Oh, how like you that is!" Miss Lincoast interrupted, impatiently. "How like you! Nobody's ideas can possibly hold a grain of truth save your own! But come. We have talked too long."

We continued to search in vain, however, and as the afternoon waned took our way back to the wagon where sat the young stable-man, calmly smoking. Beside the trail was piled a heap of jagged, irregular black stones.

"Maybe these are what you have been lookin' for, lady," said he.

"Upon my word, I believe that he has found it!" I exclaimed, for even a cursory examination convinced us that the rusty fragments were meteoric iron.

"But where?" Miss Lincoast exclaimed, her voice trembling a little from the suddenness of the *denouement*.

"Four or five hundred yards off to the right, by those rocks you can see yonder," replied the man.

"Thought I would look around a little on my own account, after you had gone," he continued, smiling. "These queer black stones were about the first things I ran into.

"I had a stint of it getting that biggest one here!" he added.

"Had to roll it most of the way. It is even heavier than it looks."

The principal fragment, or mass, the one in which I was certain that the platinum spheroid must be encysted, was an angular, beech-nut-shaped mass, about thirty inches in length and much pitted by oxidation. Nowhere upon it, externally, was there a trace of welding or other human manipulation. It would have passed muster as a meteorite in any scientific collection. In weight it must have been nearer three hundred pounds than two.

The united strength of both the driver and myself was requisite to raise and place it in the wagon. The smaller fragments we left by the roadside, for the time being; and not to overload the wagon, Miss Lincoast and myself walked down the mountain, — a rather silent and joyless trudge, as it proved, for my companion, much moved by the sight of that ominous black mass and the associations which it awakened, scarcely spoke on the way. I could easily understand that she was thinking of many things and in doubt of them all. The finding of the spheroid, too, had brought us undeniably to the point where our views conflicted; and we went back to the Springs by train, wrapped each in a species of reserve which neither could consistently emerge from.

## V.

### A BIT OF THE QUEER.

Next day by Miss Lincoast's order the *aerolite* was transported from Manitou to the Springs, and in the afternoon was set out as a curiosity, on the piazza of the hotel where she and her father were living; and although the subject was not alluded to in our conversation at table and elsewhere, it was manifest that she was studiously fulfilling and intended to fulfil, literally, the promise that she had given Gladwright. Her silence, more than any words she could have uttered, seemed to bid me take notice of this fact, and also to challenge me to do aught in the matter, either to let or hinder.

I took thought on my own part, that night, and could but say to myself that my attitude toward both her and my dead friend was as froward and odious as could well be imagined. Nevertheless, I continued on that night and next day to revolve many and various schemes for putting the thing out of the way.

I had resolved that I would not lay sacrilegious hands on it myself, but if possible devise other expedient for accomplishing its permanent sequestration. That is to say, I would not myself throw it down a well or pulverize it with a sledge. It may be a merely squeamish distinction, but I could not have brought myself to do that.

Chance finally helped me out, as it helps us so many times; there is little wonder that the ancients sacrificed to Good Fortune.

There had been a noisy "silver" meeting in the place during the afternoon, called and addressed by three or four delegates or emissaries from the party of disorder in Denver, for the purpose, really, of enrolling volunteers for an armed resistance to both the State authority and the general government. I had listened to some of the incendiary speech-making with a fresh sense of wonder as to what would happen if the country were ever actually to lapse under the control of such men. Two of them in particular were as heady, truculent fellows as I had ever seen; hard, liquor-soaked, pestilent ruffians, hate-breathing and envenomed.

"How more than trebly unfortunate has the 'poor man' always been in his leaders," I was thinking to myself as I went home to the hotel that evening. With such malignants at top, if they get at top, what hope is there that art, science and all refinement would not be trodden out beneath their brutal feet? What hope that all the world's hard-earned wealth would not be eaten up and squandered in self-indulgence and indolence?

Dusk had fallen as I mounted the piazza steps; from some vagrant impulse I went around the corner to the wing side, to see if the *aerolite* were there still, and came plump upon three men on a settee, whispering huskily together. By the light of the gas-jet there, I saw that two of them were hotel waiters, but that the third was one of the Denver "delegates."

The latter said, "Good evening," for I fancy that he took me for the proprietor. "Was just askin' your men here whatever this 'ere queer-lookin' black stone on your piazza was," he said, fluently. "They tells me 't is a meetyrite a lady found."

I well knew that this was a falsehood as to the purpose of his presence there, which was probably to recruit the two men for some unlawful effort; but my familiar dæmon at once whispered, "This is your opportunity. Here is your instrument. Speak but the fitting word."

"Yes; it was found by a lady up the Peak," I said; "and I wonder that she leaves it outside. It is an aerolite, but differs from most such stones in that it contains three valuable metals, platinum, iridium, and osmium. Platinum is not quite as valuable as gold, but far more so than silver. This mass contains at least eight thousand dollars worth, perhaps ten, as a few licks with a sledge will show."

I touched the fragment carelessly with my cane and, not to evince further interest in the conversation, walked away.

Next morning, strange to say, the *aerolite* had disappeared from the piazza!

With less of guilt than I had feared to be encumbered with, I was able to assure Miss Lincoast, when I bade her "good-by" on my way to the station that morning, that I had little idea what had become of it.

"Heaven help you," she replied. "Yet I have learned that there are some of your promises which you do keep."

Ah, Gladwright — dead! There are moments when the wraith of your spheroid is heavy about my neck; and one day it may bear me down to the depths. But I have never much feared that the spheroid itself will ever appear again in the realms of light.

Plunged down a well, some one might at length have fished it up. Buried in the ground, torrents might have washed it out. Thrown into the sea, tidal waves or long-laboring surges might have rolled it ashore, or the submarine folk found it. From the smelting furnace it would have tumbled forth unscathed; and even had I hurled it down the crater of Vesuvius, some future eruption might have tossed it into Naples, intact.

But once within the maw of that sordid selfishness to which I so ruthlessly consigned it, there is no possibility of a resurrection.

## A MERYCOLE.

THE first autumnal chill of the advancing season had come to us that evening, Aug. 29; — for Maine verges northward under the Seven Plow-oxen. From over the hills and woods, White Mountainward, the wind puffed sturdily; the cold came with it, as it often comes here by the last night of summer.

The Casual Worker, who had been with us four days on this particular occasion, laid a fire in the laboratory fireplace, the first of the season.

What a cheery blaze it was! The '87 Graduate drew up a creaky old basket-bottomed rocking-chair, and raised his very American heels against the right jamb; the Neophyte hauled in an oak settee upon the left flank; and the Casual Worker lighted a cigar, in the middle background. From their general air, it was plain that there would be chat, argument, or agnosticism, as the case might be.

Peter Bubier, the chore boy, came in, fetching great sticks of four-foot wood for the fire from the shed, and unwittingly furnished the theme; for Peter was chewing his cud. He is a French Canadian from the Three Rivers region, emigrant from a parish up the St. Maurice, but claims to hail from Three Rivers, for he does not wish his priest to learn of his whereabouts.

The trouble is about Peter's cud. We fancied at first that it was tobacco or spruce gum which he held so constantly in his mouth. The cud, however, proves to be something of a phenomenon; Peter actually raises and re-masticates a part of his food, — ruminates, in fact. Shall we call it *bovinthropy?* Lycanthropy has been often described. Is rumination in man a reversion of type, a freakish survival, or is it a still more freakish instance of nature's perverse imitativeness across the gulf of species? What is the true history of the vermiform appendix which has now fallen into the hands of surgery? Formerly we called appendicitis "inflammation of the bowels," or in some cases "peritonitis," and died resignedly, without an operation. Now the removal of the appendix v. is "indicated," and the elect are saved. Indeed, a young surgeon who visits us here says that this antiquated appendix v. should be removed from each nursing infant, and save trouble in the adult; no aspect of the thymus gland discussion terrifies him. "It ought to be out," he asserts. He would like exceedingly to examine Peter's, and runs an inventory glance over him at times, the full significance of which Peter himself has no conception of, or we would not keep him long.

Peter is a sturdy, well-knit little dark fellow of twenty-four, pure French from the days of Roberval, scrubby, provincial French. He is alert, content, a good worker.

He fetches in the armful of four-foot wood; and the Neophyte, swinging aside for him to throw it in the wood box, says, "Well, Nebuchadnezzar, how does your old cud taste to-night? Sit down here, Peter, and tell us what the priest said to you."

"Said, ''Pit it,'" Peter replies, reluctantly.

"Spit it out?"

"*Oui, oui;* ''pit it.'"

But he will not sit down with us to talk about it.

"Dis is too hort here," he exclaims, pointing to the fire; it is but his excuse to get away. The truth is that Peter is afraid. We know the facts, however. The Canadian priest had overhauled Peter's nutritive habits and decided that they were unregenerate, anti-Catholic and subject to church authority. Man redeemed from animalism and a candidate for salvation by grace of our Lord and Saviour must have done with the cud business. With the weight of apostolic authority behind him, he directed Peter to repress his desire to raise the cud by all the force of his will and by prayer; and if anything rose inadvertently, to reject it at once from his mouth.

And Peter "'pit it," and in consequence grew wondrous ill at ease; he could not sleep; he became thin and unwell. At length he ran away to Maine without the knowledge of his priest. But he was in fee of a sweetheart; and goaded by his fears of rivals, he contrived to write a letter to her wherein he acquainted her of his constancy and his present whereabouts, but enjoined strictest secrecy as to the latter.

The Acadian damsel replied, promising to be silent as the grave; but her priest who had heard that she had received a letter, wrung the entire matter from her at confessional, whereupon the girl wrote yet again to Peter asserting that she had told no one!

Hence on a day which he could not know, his priest wrote to a priest at Bangor enjoining Peter's reclamation to parochial authority, and the latter came to find him. For be it known that the French Canadian who now comes down into New England is in a condition not a little resembling that of a fugitive slave in the Northern States, before the days of John Brown.

"Ah, bitter irony of time, that Puritania should but too surely become a Romish province, and its soil groan under an ugly burden of Catholic church architecture!" the Neophyte exclaims.

It is too late; at least, our young associate says so. The mischief is already done, he asserts. That priceless freedom of thought which brought forth our national idea and founded the free public school is to be smothered by the Papist catechism.

The Norland hill country which nurtured Websters and Sumners passes under the yoke of that church whose synonym is intellectual blight; that church which so jealously inoculates the tender mind of the child with doctrines which make a mental eunuch of him through life. The Neophyte really thinks so; and he adduces history and physiology in evidence.

In New England, of all lands, the mental condition of Spain, Italy and Mexico is to be reproduced. That very liberality and breadth of thought which inspired the framers of our national Constitution to make America the refuge of the oppressed everywhere, has proved our undoing; for the oppressed brought along with him the oppressor enshrined in his bosom.

And now whitherward shall the lover of intellectual freedom turn, to stand clear of the octopus clutch of that hierarchy and the fatal incubus of its indoctrination? To Australia? A century hence Anglo-Saxon Australia will eclipse America, — if only Australians are warned in time by the race catastrophe in America. Geographically, America has shielded Australia and stood to it as the flood-gate and sluice-rack to divert the dirty tides of emigration. Trebly fortunate in this, the progressive race may find on this last of earth's continents a field for its slower growth and larger development.

An English writer, the most remarkable literary light of this generation, who has lately made New England his *quasi* place of abode, has written not wisely nor well of the decadence of New England and the "going to seed" of Puritanism, having for his text and his illustration a rural county of our north country, to which as yet few aliens have penetrated. In the condition of life in that locality he believed that he saw the natural outcome of the Puritanic flight to America.

Strange that a man as acute of vision should have gone so far astray in his observation!

What he saw in that rustic county was but the graves of the Puritans. The Puritans, indeed, are no longer in New England. They migrated years ago; have been migrating for a century. First came the migration to Pennsylvania and Western New York; then to Ohio, Illinois, Wisconsin, Michigan, Iowa and Kansas, all of the corn and wheat States. For a century, the brightest, the strongest and the most energetic of New England's sons and daughters have taken their way westward. The only wonder is that anything remains over and above such an enormous depletion of the best blood, brain and muscle; that so much of intelligence and energy is left behind. Why, all the Midland States, as also Texas, California and Oregon, are but so many later New Englands. The leading spirits, the owners of property, the controlling and directing minds are nearly all New Englanders, or of New England parentage.

Pioneers from these six eastern Anglo-Saxon colonies carried the first germs of business enterprise and civil government to every new territory of the national domain. The extreme truth of the above assertion will prove a matter of astonishment to any one who will take the trouble to inform himself of both the early history and present social and industrial condition of every State of the Republic, save eight of the Southern States; and since the abolition of slavery, these eight States are being revivified from the same fruitful source. It is not more than the truth, that the well-spring of the national life was from that one lonely colony on the Massachusetts coast, in 1620. Nor in the now known correlation of the physical and moral forces of man is this a fact to excite wonder. For what was the dominant idea of the New England colonist? Freedom of thought promoted by public instruction, and self-government based on such freedom. That was the Puritanic *idea;* and for the fostering of it there went self-denial, continence, temperance in all things, enforced with an austerity sterner than Cato's. Such an idea, thus fostered, could but prove a prevalent force in the world, a force that will be felt for a thousand years.

The Puritans still live in every State of the nation, and lend power and vigor to the national life, and will so live, even although the sterile soil of New England is populated by immigrant aliens, and desecrated by that paganized form of Christianity which the Puritans abhorred.

New England was the cradle of the nation's infancy; but now the child has grown and left it, and the old cradle is relegated to the barn for pups and kittens to nest in. It may not be worth while to grieve or indulge in sentiment over it, yet it once rocked a divine child. Let that only be remembered. Let it be as when we visit Greece, or the shrine of a hero of old Ordure of degeneration will lie about; and as we pore, a vermin-infested beggar will whine, "I too am a Puritan! For the love of the Virgin, a few cents."

Such are the vaticinations of the Neophyte touching Romanism in America. On this woe he out-Cassandras Cassandra. His lament is not common property with us.

But Peter caught sight of the Bangor priest coming to his boarding place one evening, and slipping out at a back door fled again far across the country and took service with us.

As we talked of these things before the first autumn fire that night, and predicted the future of this quarter of our common country, Peter sat on the doorstep outside and chewed his cud. It may be partly fancy, but he really appears to lapse into an ox-like mood as he ruminates; the calm of an internal preoccupation takes possession of his brain. Otherwise his whole aspect, day by day, is one of settled, plaintive anxiety. His sweetheart and his priest lie heavy on his heart and lower its beating. Yet the dire corporeal stress of his outlawed cud is heavier still; and his life drags on, beset with miseries. He is happiest when ruminating, at least, calmest, a bovine calm.

Observation shows that he masticates at meals, as thoroughly as the average; and his teeth are excellent. Even after a breakfast of well-cooked oat meal, he shows a tendency to raise particles, but not as much as after a dinner of meats, vegetables, green lettuce, etc., when for several hours subsequently, of an evening, Peter is busy indeed. While hard at work sawing wood, or wheeling fuel into the shed, Peter rarely raises his cud, but on sitting to rest for a time, will begin soon to do so and munch away with apparent satisfaction, particularly when his breakfast has consisted of tough beef-steak. Nor is he apt to evince much appetite for his noon lunch if he has not had time during the morning to re-masticate his breakfast. Apparently, rumination is necessary to his physical well-being; and no doubt he was a sufferer in many ways not easily described, while attempting to break off the habit or function, by rejecting what rose to his mouth. It is not unlikely that his life might have paid the forfeit of a rigid adherence to the commands of his spiritual director; and that in a strictly literal sense, Peter had been obliged to choose between a continuation of his terrestrial life and the sacerdotal promise of a heavenly one.

In some way his priest has become aware of his whereabouts, although Peter does not know it. These small modern inquisitors have means of obtaining information which they employ to trace runaways from the parochial authority. Peter had been with us for no more than a month, when a very civil letter was received at the laboratory from a priest at a neighboring factory town, inquiring whether one Pierre Bubier, who was described with the accuracy of an anthropometric chart, was sojourning with us.

To this tentative missive, the Neophyte replied with the unwise warmth of youth, stating the facts, giving the physiological data of the case, pointing out the folly of interference with a function so deep-seated and requesting that the stress to which the poor fellow had been subjected should cease at once. In his ardor the Neophyte demanded that a promise to cover this latter request should be communicated through him to Peter.

In reply to this humane but indiscreet outburst, there was presently received as smooth a rejoinder as one would ever have expected from Machiavelli himself. In it showed forth that well-organized, long-perfected policy of dominating mankind which has been maturing for fifteen centuries. The promise, forsooth, was not forth-coming; and summed up, the letter was to the effect that the Holy Church, and not laymen, must decide by its canons all final questions of life and salvation.

We made merry with the Neophyte that evening, and put him in a state of mind so heated that he again replied to his canonical correspondent, avouching succinctly that if Peter were molested he would lodge a complaint against his persecutors and test the matter in the courts. An answer to this democratic ultimatum has not yet reached us.

## BLOOD-MONEY.

THE loons were calling on the lake. Not the hollow laughter of those strange old denizens of our northern inland waters, heard in their flight from pond to pond, or while breasting the waves in the teeth of squall and wind, but the long, clear, alto invocation of bird to bird in the twilight or the early morn. There is not a woodland note of beast or bird that can rival this mellow horn-blower, nor diffuse abroad so blessed a sense of sylvan peace and harmony.

It was a very warm evening, warm even for July, and having the laboratory quite to myself that week, I sat in solitary content at the open window — for the work of the day was done — listening to the musical fanfare from the still faintly shimmering bosom of the quiet Pennesseewassee.

Tree frogs chirrupped. A bat fluttered his vanes, zigzag, in the dusk. Quite as uncannily, a belated cyclist flitted along the road, a fleeting shadow without appropriate sounds of motion; and then, from beneath the wayside maples, another shuffling shadow emerged, twin shadows, which drew near the laboratory door beneath my window.

Dimly I was now able to discern that these latter late comers were a boy and what seemed a large, reluctant dog.

In furtherance of our work in minute anatomy, dogs are at times made use of; first and last, not a few have been purchased, mostly very old dogs, such as their owners are not unwilling to part with, stipulating only that they shall have an " easy death." Hence I was not wholly at a loss to conjecture the object of the boy's visit, and, speaking from the inner darkness of the window, said, " So, boy, what are you doing with that dog? "

The boy jumped visibly, for he had not seen me.

" Don't yer wanter buy him? " he asked hurriedly; and it seemed to me that his voice rang false, as of a boy with a load on his conscience.

" Perhaps," I replied, and going to the basement door, opened it and bade him lead in his canine property for inspection.

The boy entered with hesitation, and when I turned, after lighting a lamp, I saw that his hands trembled as he held the rope attached to the dog's collar; but he was not an ill-looking boy, and I conjectured that his nervousness was due to certain of the dreadful stories which he had heard concerning the laboratory and what was done in it.

As for the dog, it was a nice, gentlemanly old Newfoundland, black and white and very shaggy.

"Whose dog is it?" I asked.

"It belonged to the old widder Stone, but she said I might sell it," replied the boy. "He is gettin' old and lame and he's got rheumatiz, and she said I might sell him to you, if you would promise to kill him quick and not hurt him before you *cut him ter pieces*."

"She did? What is your name?"

"Fred Marker, sir."

"What do you ask for this dog?"

"I want to get a dollar, sir."

"Do you know how old he is?"

"Mis' Stone says he's seventeen."

I looked the dog over, and on his part, he returned the compliment with a deprecatory wag of his tail; evidently a nice old dog, accustomed to good usage, and hence not unreasonably distrustful of strangers. Judging from his teeth, orbital cavities, and his slow movements, I did not much doubt that he might be towards seventeen years old.

"What's his name?" I asked.

"Beaver — Beaver Stone"; and Beaver confirmed the statement with another slight wag of his tail.

"And you say Mrs. Stone knew that you were fetching the dog here?" I asked.

"Yis sir. She said she did n't believe that you 'cut dogs up alive,' but that you must promise not to, and promise to give him something when you killed him, so he would n't feel it," said the boy hastily. "She said I should n't leave him here unless you promised that."

I had heard of the old lady Stone who lived three or four miles further out in the country, also of a family of farmers named Marker, near the Stone place. In fact, I was pretty sure that I had often seen this boy go past on his way to and from the village, two miles distant. It occurred to me, however, that I had seen or heard of a grandson of old Mrs. Stone, a boy whom they called Ben, not far from this Marker boy's size and age.

" But what about Ben Stone? " I asked. " I should have thought Ben would have brought the dog and got the dollar."

The Marker boy was silent for a moment, then said that he guessed Ben felt too badly about it to fetch him.

That, too, was a reasonable supposition; and on the whole, I did not much doubt the truth of the Marker boy's story. He was a country-bred boy; and country boys generally tell the truth. Nature of her own accord does not breed liars. At a laboratory in a great city one is compelled to be more suspicious of the tales of those who fetch dogs for sale.

" Very well, Fred Marker, I will buy the old dog, and you may say to Mrs. Stone that her wishes shall be respected," I replied. " Lead him into the stall there, next beyond the guinea pig coops, and tie the rope in the ring."

Then, after seeing that the dog had fresh water, also food, and a comfortable bed for his old bones, I gave the boy his dollar which he pocketed with a triumphant look and departed without more ado.

This was the night of the 3d, and next day was the 4th of July which, however, in this rural locality, resembled Sunday rather than the usual noisy holiday; for the " celebration " was at Lewiston, twenty-five miles distant, and nearly all the young folks had gone thither, at a very early hour. There was an excursion rate by rail, of one dollar for the round trip.

The day proved very hot, and such a warm night as followed we rarely have in Maine. It was well-nigh impossible to sleep, and I sat at an upper window of the large working-room of the laboratory till past midnight. Many wagons, filled with talking, laughing boys and girls, passed at about eleven o'clock, on their way home from the " celebration."

At last I fell asleep, despite the heat, but seemed scarcely to have done so, when an electric rattle buzzed sharply in my room, a rattle attached to a set of " burglar alarm " wires which guard the windows and doors of the basement, a device which we allowed a young electrician to set up rather as a curiosity than from any need of protection. It was the first time the rattle had ever gone off in the night, and rousing, I listened, wondering what a Fourth-of-July burglar could possibly want among the guinea pigs, frogs, lizards, old dogs and kittens in our basement.

There was unmistakably a noise below as of some one moving stealthily about; and, rising quietly, I lighted a small bull's-eye lantern, the slide of which I closed. There is a little circular iron stair leading from the water room to the basement, and opening the door gently, I first listened there, then descended, for I now heard the noise again at the far end of the basement; and before I had reached the bottom of the stairs, I saw the glimmer of a match near the furnace, fifty or sixty feet away. The match blazed out brightly and I distinguished the form of a person holding something in his left hand which reflected the light.

For a burglar he seemed to be a careful one, for as the match burned out he extinguished it conscientiously with his foot. Having taken his bearings by the matchlight, he came slowly down the room. feeling his way; and, meantime, not to be seen at once, in case he struck another match, I stepped behind the stairs.

As I conjectured, he soon lighted a second match; and his face, being now turned toward me, I saw that he was but a boy, and a very anxious, scared-looking boy at that, apparently not more than fourteen years old. The object in his hand, however, was a formidable knife, a long, ugly butcher's knife, such as farmers use for their autumn pig sticking.

Evidently this was a boy, bent on a really serious or criminal undertaking, and I began to reflect how I should best seize and disarm the young rascal, since he might prove murderously disposed. Yet from the glimpse I had caught of his frightened, childish face, I could scarcely believe him a burglar. It even occurred to me that it might be a boy walking in his sleep, but then, I reflected, that sleepwalkers do not light matches.

Meantime the youngster was poking his way toward a door which he had discovered, leading into the room where our "pets" are kept. He fumbled for the knob, then turned it gently and opened the door a bit. I could hear him breathing fast and hard, as he listened at the door; plainly he was much excited. Then he chirruped with his breath betwixt his lips, and whistled softly, very softly, scarcely above a whisper.

The mystery was solved. The boy was undoubtedly trying to find that old dog which I had bought the previous evening; and as if to confirm the conjecture, I heard the dog's tail thump against the side of his stall, and then a low whine.

My first thought was, now, that the boy was Fred Marker, come back to steal the dog; yet from the glimpse I had caught of this lad's face I was quite positive that he did not resemble the Marker boy.

Considerably interested, I remained quiet to see what would follow. Another match flashed in the "material" room, and then old Beaver's tail fairly beat a tattoo. I could hear a rustle and a stir, as of patting and fondling. Once the dog whined out his great joy; but the boy said, "Sh! Sh, Beaver!" under his breath. The ring and staple tinkled; I could even hear the boy's fingers untying the rope. Then, old Beaver's tail still drumming, they came out of the stall to the door.

I thought that it was time to have a better understanding, and suddenly opening the bull's eye of the lantern, directed the flash in the boy's face, as he came through the doorway.

He uttered the strangest shriek that I ever heard. Such a dazzling flash in utter darkness will startle and bewilder a cool-headed person. But this boy's mind was already agitated and no doubt had in it a background of terrible tales which he had heard about the laboratory. He cried out and leaped backward. Old Beaver too barked and growled savagely.

I advanced a step and kept the light on them, myself in shadow.

"What are you doing here?" I said.

The boy gasped and cried out, menacingly, shaking the knife.

"He's my dog! He's my old dog! You sha'n't have him! I'm a-goin' ter take him out of here! I'm a-goin' ter take him out of here! I'm a-goin' ter take him out of here!"

I am quite sure that he would have fought. In spite of his terror the lad had a streak of grit in him. The light nearly blinded him, but he gripped the knife and came forward. Beaver also was ready to second his attack.

"Behave yourself. Put up that knife," I said. "Is that your dog? You need not be alarmed."

"Yes, it is my dog and I'm a-goin' ter take him out of here!" he cried, resolutely.

"But Fred Marker sold us the dog," I said. "He told us that Mrs. Stone wanted him brought here."

"That Fred Marker lied! He stole old Beaver, he did!" cried the boy, vehemently. "Grandma never said so."

"Are you Ben Stone?"

"Yes, and old Beaver is my dog. He sha'n't be killed and cut up!"

"If the dog is yours, you need not be afraid. You can take him away. We do not want him," I said, reassuringly. "Lead him out. I will show you the door."

With that, this boy who had been so full of fight, burst out crying tumultuously. But he followed me in evident anxiety to gain the door and get out.

"What led Fred Marker to steal your dog?" I asked, when we were at the door.

"He wanted to get a dollar to go to Lewiston, to the Fourth o' July celebration, the mean scamp!" replied Ben Stone, vindictively, through his tears.

"That was indeed a mean trick," I said. "So he sold your dog to be killed, so that he could get a dollar?"

"Yes, he did; and I never 'd a found him out if Mis' Forster had n't met him sneakin' along the road, leadin' Beaver, just dark last night. She said she 'd bet he was comin' here, and that old Beaver was goin' ter be cut up."

"Well, it is all right now, Ben; and I am sorry that you had to break in to get old Beaver. Next time, come to the door and tell me what you want."

"I — I — did n't know," faltered Ben and edged away into the darkness, making for the highway.

But he halted in the shadow of the maples and called back, hesitantly, "Thank ye, Mister."

Then he and old Beaver both ran like good fellows, for home.

The Neophyte, on his return to the laboratory a few days afterwards, was of the opinion that parish work ought to be done on the Marker boy and sent the following type-written notification to him: —

"BLOOD-MONEY."

"Fred Marker is wanted at the Laboratory *in place of* Beaver Stone whom he stole and sold there to get a dollar to go to the Fourth of July celebration. Something will be given him to take, so that *it will not hurt him much*, only for a minute! He had better come and give himself up and save further trouble."

Evidently the Marker boy does n't think so. They say that he has not been past the laboratory since, and that when he goes out to the village he takes another road three miles out of his way.

# THREE HUNDRED LINES OF LUCRETIUS.

## PREFATORY NOTE.

So great is the debt of modern biological science, and of all science, to Demokritos, Epikuros and Lucretius, that neglect to venerate their memory is of the nature of impiety. For centuries supernaturalism has heaped obloquy upon their graves, and striven in a thousand foolish tomes to make materialism a term of reproach. None the less, the grand rennaisance of science, during the last two centuries, is a re-incarnation of the doctrines of nature held by these sages.

For crude and meager as was the Epicurian and Lucretian materialism, embracing as it did only *the lifeless side of Matter*, it was nevertheless, the first right, intelligent step toward the study and comprehension of nature. The "atom" of Demokritos was the corner-stone of modern chemistry. The *semina rerum* of Lucretius are the germs of modern biology.

Mindful of this boon from the mighty dead, a humble student of these long-silent masters ventures like a school-boy to translate his three hundred lines.

I am warned in time by the failures of our greatest versifiers not to attempt to render classic verse into English rhyme. My effort has therefore been to translate the words of Lucretius into plain English, ardently desiring, but as often failing, to embody his earnest, poetic spirit.

## T. LUCRETII CARI, DE RERUM NATURA.

### Book I., 1–14.

Æneadum genetrix, hominum divumque voluptas
Alma Venus, cæli subter labentia signa
Quæ mare navigerum, quæ terras frugiferentis
Concelebras, per te quonium genus omne animantum
Concipitur visitque exortum lumina solis
Te, Dea, te fugiunt venti, te nubila cœli
Adventumque tuum, tibi suavis dædala tellus
Summittit flores, tibi rident æquora ponti
Placatumque nitet diffuso lumine cœlum.
Nam simul ac species patefactast verna diei
Et reserata viget genetabilis aura favoni
Æriæ primum volucres te, diva, tuumque
Significant initum perculsæ corda tua vi.

*Translation.*

Fostering Venus, Mother of Rome, Delight alike of men and of the gods! Thou who, beneath the ever-moving signs of the zodiac, givest Life to the fruitful earth and the navigable sea!

For verily through thee every species of living creature is conceived and, borne forth, beholds the light of the sun.

At thy approach, Goddess, rude winds and clouds flee away.

For thee the varied earth puts forth flowers.

For thee the broad expanses of ocean shine and the calmed skies beam with light effulgent.

For as soon as the vernal influence of day unfolds and genial breezes stir abroad, the birds first of all signalize thee in song, their hearts pervaded by thy power.

### Book I., 14–27.

Inde feræ pecudes persultant pabula læta
Et rapidos tranant amnis; ita capta lepore
Te sequitur cupide quo quamque inducere pergis.
Denique per maria ac montis fluviosque rapacis

Frondiferasque domos avium camposque virentis
Omnibus incutiens blandum per pectora amorem
Efficis ut cupide generatim sæcla propagent.
Quæ quoniam rerum naturam sola gubernas
Nec sine te quicquam dias in luminis oras
Exoritur neque fit lætum neque amabile quicquam,
Te sociam studeo scribendis versibus esse
Quos ego de rerum natura pangere conor
Memmiadæ nostro, quem tu, Dea, tempore in omni
Omnibus ornatum voluisti excellere rebus.

*Translation.*

Then the wild herds gambol in their pastures and swim the rapid streams.

All living things, in fine, captivated by desire of thee, follow whithersoever thou leadest the way.

Over seas and mountains and rushing rivers, in the leafy homes of birds and amidst green fields, thou, infusing love in the breasts of all alike, incitest them eagerly to propagate their kind.

Since thou alone art queen of nature, and neither without thy favor can any living creature issue to the pleasing coasts of light, nor become joyous and gladsome, I earnestly desire thee to be the companion of my song and of my verse, which I aspire to compose concerning the nature of things for my friend Memmius, whom thou, O Goddess, hast willed ever to excel others, accomplished in all respects.

**Book I., 54–61.**

Nam tibi de summa cœli ratione deumque
Disserere incipiam et rerum primordia pandam
Unde omnis natura creet res auctet alatque
Quove eadem rursum natura perempta resolvat
Quæ nos materiem et genitalia corpora rebus
Redunda in ratione vocare et semina rerum
Appellare suëmus et hæc eadem usurpare
Corpora prima, quod ex illis sunt omnia primis.

*Translation.*

For now I shall begin to set forth much pertaining to the gods, and take into estimation the origin of the universe and the manner in which nature creates, nourishes, and sustains all things which have life, as also the mode of their dissolution; such elements as, in the elucidation of our theme, we are accustomed to term Matter and the germs of things, assuming them to be primary bodies from which all objects in nature are derived.

**Book I., 62–79.**

Humana ante oculos fœde cum vita jaceret
In terris oppressa gravi sub Religione
Quæ caput a cœli regionibus ostendebat
Horribili super aspectu mortalibus instans,
Primum Graius homo mortalis tollere contra
Est oculos ausus primusque obsistere contra
Quem neque fama deum nec fulmina nec minitanti
Murmure compressit cælum, sed eo magis acrem
Inritat animi virtutem effringere ut arta
Naturæ primus portarum claustra cupiret.
Ergo vivida vis animi pervicit, et extra
Processit longe flammantia mœnia mundi
Atque omne immensum peragravit mente animoque,
Unde refert nobis victor quid possit oriri,
Quid nequeat, finita potestas denique cuique
Quanam sit ratione atque alte terminus hærens.
Quare Religio pedibus subjecta vicissim
Opteritur, nos exæquat victoria cælo.

*Translation.*

When Human Life lay foully torn and exposed, crushed to the earth beneath the heel of Religion that reared her head in the heavens, impending over mortals with malign aspect, a Man of Greece was the first to raise his eyes resolutely against her and stand at bay.

Him neither fear of the gods nor thunderbolts intimidated, nor portents in the skies, but rather roused the innate courage of his soul that he should be the first to break down the jealously guarded portals of knowledge.

Therefore the vivid force of his mind has prevailed and, entering within these barriers, he has proceeded far beyond the flaming walls of the world, and in thought and conception has journeyed through the immensity of space.

Thence he now returns to us as a conqueror, able to teach us what can take place and what cannot be; in short, how and why the powers of nature have their limits and are held within deep-set boundaries.

By his victory, therefore, Religion is cast down from her place of pride; and we, in turn, are made the peers of heaven.

### Book I., 80-101.

Illud in his rebus vereor, ne forte rearis
Impia te rationis inire elementa viamque
Indugredi sceleris. Quod contra sæpius illa
Religio peperit scelerosa atque impia facta.
Aulide quo pacto Triviæ virginis aram
Iphianassæ turparent sanguine fœde
Ductores Danaum delecti, prima virorum.
Cui simul infula virgineos circumdata comptus
Ex utraque pari malarum parte profusast,
Et mæstum simul ante aras adstare parentem
Sensit et hunc propter ferrum celare ministros
Aspectuque suo lacrimas effundere civis,
Muta metu terram genibus submissa petebat
Nec miseræ prodesse in tali tempore quibat
Quod patrio princeps donarat nomine regem;
Nam sublata virum manibus tremibundaque ad aras
Deductast, non ut solemni more sacrorum
Perfecto posset claro comitari Hymenæo,
Sed casta inceste nubendi tempore in ipso
Hostia consideret mactatu mæsta parentis
Exitus ut classi felix faustusque daretur.
Tantum Religio potuit suadere malorum.

*Translation.*

In these themes I fear lest perchance thou mayest think, O Memmius, that we are entering on prohibited topics, as if beginning a course of crime.

But on the other hand, this same Religion has frequently incited men to wicked deeds, as when at Aulis the chiefs of the Greeks reddened the altar of virgin Trivia with the blood of Iphigenia.

Her maiden tresses, released from the fillet, dropped to equal length beside each cheek, and at once she beheld her grief-stricken sire standing before the altars, the expectant priests, concealing the sacrificial knife, and her fellow-countrymen in tears.

Speechless from fear, she dropped on her knees to the earth; nor did it avail the unfortunate maiden in a crisis so evil, that she had been the first to bless the king with the sacred name of father.

Lifted by the hands of zealots, she was dragged trembling to the altar, not that, a solemn rite being performed, she should hear the joyous hymeneal hymn, but that chaste in her virgin prime, she should be foully immolated by that father's hand, in order that a prosperous voyage might attend the fleet.

To such enormities has Religion prompted men!

### Book I., 102–119.

Tutemet a nobis jam quovis tempore vatum
Terriloquis victus dictis desciscere quæres.
Quippe etenim quam multa tibi jam fingere possunt
Somnia quæ vitæ rationes vertere possint
Fortunasque tuas omnis turbare timore!
Et merito; nam si certam finem esse viderent
Ærumnarum homines, aliqua ratione valerent,
Religionibus atque minis obsistere vatum.
Nunc ratio nulla est restandi, nulla facultas,
Æternas quoniam pœnas in morte timendumst.
Ignoratur enim quæ sit natura animæ,
Nata sit an contra nascentibus insinuetur,
Et simul intereat nobiscum morte dirempta
An tenebras Orci visat vastasque lacunas
An pecudes alias divinitus insinuet se,
Ennius ut noster cecinit qui primus amœno
Detulit ex Helicone perenni fronde coronam
Per gentis Italas hominum quæ clara clueret.

### *Translation.*

And wilt thou, too, Memmius, terrified by the frightful stories of poets and priests, seek to escape me?

How easily, indeed, such visionary tales can be invented to disturb the course of your life and mar your pleasures with idle forebodings!

Nor is it wholly strange that this should be so. Yet if only men knew that there was a fixed boundary to the ills which can befall them, they would be able to withstand these threatening fictions of religious superstition.

But since now they fear eternal punishment after death, they can summon no faculty, no courage to resist.

For especially they are ignorant what the nature of the soul is; whether it is produced in our bodies and engendered with them, or whether, on the contrary, it is implanted in us at birth; whether it perishes with the body, dissolved at death, or glides away to haunt the vast and gloomy lakes of Orcus; or yet, undying, insinuates itself into the bodies of other animals. Even as our Ennius has sung of it, who first brought from immortal Helicon a crown of perennial leaf, celebrated throughout Italy.

### Book I., 146-158.

Hunc igitur terrorem animi tenebrasque necessest
Non radii solis neque lucida tela diei
Discutiant, sed naturæ species ratioque.
Principium cuius hinc nobis exordia sumet,
Nullam rem e nilo gigni divinitus umquam.
Quippe ita formido mortalis continet omnis,
Quod multa in terris fieri cæloque tuentur
Quorum operum causas nulla ratione videre
Possunt ac fieri divino numine rentur
Quas ob res ubi viderimus nil posse creari
De nilo, tum quod sequimur jam rectius inde
Perspiciemus, et unde queat res quæque creari
Et quo quæque modo fiant opera sine divum.

*Translation.*

This fear, this darkness of the mind, therefore, is not to be dispelled by sunshine and the bright darts of day, but by reason and a knowledge of nature.

Of this knowledge the first principle set forth in our discourse shall be that no visible object, or thing, is ever produced from nothing, even by the gods.

But now everywhere mortals are restrained and held fast by fear, because they behold phenomena on earth, and in the sky, the causes of which they are unable to perceive, and hence fancy that divine intervention is present.

But when we shall have clearly perceived that nothing is ever directly created from nothing, we shall follow our theme more clearly and shall comprehend in what manner every natural object comes into existence and how all things are done without the intervention of the gods.

### Book I., 215-217.

Huc accedit uti quicque in sua corpora rursum
Dissoluat natura neque ad nilum interemat res.

*Translation.*

It happens, too, that nature resolves everything into its own original elements and never reduces anything to nothingness.

**Book I., 322–329.**

Postremo quæcumque dies naturaque rebus
Paulatim tribuit, moderatim crescere cogens,
Nulla potest oculorum acies contenta tueri;
Nec porro quæcumque ævo macieque senescunt,
Nec mare quæ impendent, vesco sale saxa peresa
Quid quoque amittant in tempore cernere possis,
Corporibus cæcis igitur natura gerit res.

*Translation.*

Moreover, whatever time and nature add to objects, little by little, compelling them to gradually increase in bulk, no power of vision, never so carefully directed, enables us to perceive.

Nor indeed is what wastes away perceptible in old age. No more can one discern what the cliffs which overhang the sea, eaten by mordant salts, lose as the days go by.

Nature therefore carries on her labors by the use of invisible particles.

**Book I., 329–340.**

Nec tamen undique corporea stipata tenentur
Omnia natura; namque est in rebus inane.
Quod tibi cognosse in multis erit utile rebus
Nec sinet errantem dubitare et quærere semper
De summa rerum et nostris diffidere dictis.
(Qua propter locus est intactus inane vacansque.)
Quod si non esset, nulla ratione moveri
Res possent; namque officium quod corporis exstat,
Officere atque obstare, id in omni tempore adesset
Omnibus; haud igitur quicquam procedere posset,
Principium quoniam cedendi nulla daret res.

*Translation.*

Nor yet are all bodies held fast, bound by natural substance on all sides, since there is void, or empty space, between all such bodies.

This indeed is a truth which it will be especially useful for you to recognize, for it will preserve you from wavering in mind and constantly inquiring as to the constitution of nature, as also from distrust of my teachings.

Therefore let it be set down as a fact, that there is void in nature, intangible, empty, vacant.

If this were not the case, by no possibility could bodies be moved to and fro; for it is the nature and property of a body to oppose and obstruct movement; and this property is present in all bodies. Hence nothing would be able to move, since nothing could begin to yield, or make way.

### Book I., 346–358.

Præterea quamvis solidæ res esse putentur,
Hinc tamen esse licet raro cum corpore cernas.
In saxis ac speluncis permanat aquaram
Liquidus humor et uberibus flent omnia guttis.
Dissipat in corpus sese cibus omne animantum.
Crescunt arbusta et fetus in tempore fundunt,
Quod cibus in totas usque ab radicibus imis
Per truncos ac per ramos diffunditur omnis.
Inter sæpta meant voces et clausa domorum
Transvolitant, rigidum permanat frigus ad ossa,
Quod nisi inania sint, qua possint corpora quæque
Transire, haud ulla fieri ratione videres.

*Translation.*

For although some things may be thought to be solid, it is still possible to discern that they have pores within their substance.

In rocks and caves the moisture of water permeates the stone which everywhere weeps abundant tears.

In living creatures, too, food insinuates itself throughout every portion of the body.

Forests grow and yield fruit in their season, because nutrient particles are diffused through the trunks and all the branches, from the smallest twigs and deepest roots.

Voices penetrate the walls and fly through the closed doors of houses.

Stiffening cold enters even to the bones of our bodies.

All of which you would never observe to happen, if there were no void spaces to which certain minute particles find entrance.

### Book I., 358–370.

Denique cur alias aliis præstare videmus
Pondere res rebus nilo maiore figura?
Nam si tantumdemst in lanæ glomere quantum
Corperis in plumbo est, tantundem pendere par est,
Corporis officiumst quoniam premere omnia deorsum,
Contra autem natura manet sine pondere inanis.
Ergo quod magnumst æque leviusque videtur,
Nimirum plus esse sibi declarat inanis;
Ac contra gravius plus in se corporis esse
Dedicat et multo vacui minus intus habere.
Est igitur nimirum id quod ratione sagaci.
Quærimus admixtum rebus, quod inane vocamus.

*Translation.*

Finally, why do we see some objects surpassing others in weight, although no greater in bulk?

For if there is as much substance in a given bulk of wool as in an equal bulk of lead, they should weigh the same, since it is the property and function of matter everywhere to press downward.

But void, on the contrary, remains everywhere without weight.

Hence that body which is equally as large as another, but lighter, gives evidence that it holds within itself more of void.

But on the other hand, the heavier body shows that it contains more substance and has in it much less empty space.

It is apparent, therefore, that what we call void and seek by a searching investigation to demonstrate as such, is admixed with all material things.

### Book I., 418-429.

Sed nunc ut repetam cœptum pertexere dictis
Omnis, ut est, igitur per se natura duabus
Constitit in rebus; nam corpora sunt et inane,
Hæc in quo sita sunt et qua diversa moventur.
Corpus enim per se communis dedicat esse
Sensus; cui nisi prima fides fundata valebit,
Haut erit occultis de rebus, quo referentes
Confirmare animi quicquam ratione queamus.
Tum porro locus ac spatium, quod inane vocamus
Si nullum foret, haut usquam sita corpora possent
Esse neque omnino quoquam diversa meare;
Id quod jam supera tibi paulo ostendimus ante.

### *Translation.*

But now that I may repeat and finish the argument already begun, the universe may be stated to consist of two parts, since there are material bodies, and void or empty space in which they are located and moved to and fro.

For the common sense, or perception, proves that there is such a thing as substance or matter.

Of the existence of the latter, indeed, unless the primary assumption of it is well grounded, there will be no premises by reference to which we may proceed, or in abstruse thought be able to steady and confirm the mind.

And to continue, if there be no space which we may term vacant, objects could not be located anywhere, nor any movement of them take place, even as we have pointed out a little above.

### **Book I., 459-464.**

Tempus item per se non est, sed rebus ab ipsis
Consequitur sensus, transactum quid sit in ævo,
Tum quæ res instet, quid porro deinde sequatur.
Nec per se quemquam tempus sentire fatendumst
Semotum ab rerum motu placidaque quiete.

### *Translation.*

Time, too, in and of itself does not exist as an entity. But the perception of it follows on from the sequence of events taking place in the past, also in the present and what may ensue in the future. Nor yet has any one been able to conceive of Time as separate and distinct from the progress of events and the quiet rest of objects.

### **Book I., 483-503.**

Corpora sunt porro partim primordia rerum,
Partim concilio quæ constant principiorum.
Sed quæ sunt rerum primordia, nulla potest vis
Stinguere; nam solido vincunt ea corpore demum.
Et si difficile esse videtur credere quicquam
In rebus solido reperiri corpore posse.
Transit enim fulmen cæli per sæpta domorum
Clamor ut ac voces; ferrum candescit in igni
Dissiliuntque fero ferventia saxa vapore;
Tum labefactatus rigor auri solvitur æstu;
Tum glacies aëris flamma devicta liquescit
Permanat calor argentum penetraleque frigus,

ANDOVER THEOL SEMINARY
Lit

Quando utrumque manu retinentes pocula rite
Sensimus infuso lympharum rore superne.
Usque adeo in rebus solidi nil esse videtur.
Sed quia vera tamen ratio naturaque rerum
Cogit, ades, paucis dum versibus expediamus
Esse ea quæ solido atque æterno corpore constent,
Semina quæ rerum primordiaque esse docemus,
Unde omnis rerum nunc constet summa creata.

*Translation.*

Bodies, moreover, are composed in part of the primordial elements of things, and in part of those substances which result from combinations of such elements.

The primordial elements proper no force nor violence is able to break up, since they maintain themselves prevalently by virtue of their solidity.

It may seem difficult to believe, perhaps, that anything in nature can be found so surpassingly solid. For verily the thunderbolts of heaven pass through the walls of houses, as do also noise and voices; iron glows in the furnace; rocks, grown fervid, burst asunder from the fierce energy of pent-up vapors; the firmness of gold, yielding to heat, is loosed; the frosty cold of brass, conquered by flame, is liquified; penetrant heat and cold enter silver, since we have felt each when, according to custom, holding cups in our hands, hot or cold liquids have been poured into them at feasts.

Whence it would appear that there might be nothing wholly solid in the world.

Nevertheless, since by good reason I hold the opposite opinion, give me your attention, I pray, while I make it plain in my verse that there exist elemental bodies (or atoms) of inveterate and eternal solidity: elemental particles which constitute the germs of things and from which, as we teach, the world has been generated.

Book I., 503-511.

Principio quoniam duplex natura duarum
Dissimilis rerum longe constare repertast,
Corporis atque loci, res in quo quæque geruntur,
Esse utramque sibi per se puramque necessest.
Nam quacumque vacat spatium, quod inane vocamus,
Corpus ea non est; qua porro cumque tenet se
Corpus, ea vacuum nequaquam constat inane.
Sunt igitur solida ac sine inani corpora prima.

*Translation.*

Primarily, since the nature of things is found to consist of two dissimilar components, namely, matter and void space in which all the operations of nature are carried on, it follows of necessity that each exists of and for itself, distinct from the other.

For wheresoever space stands empty, which we call void, there is no matter.

Likewise, where matter exhibits itself, empty space by no manner of means is present.

Primarily, therefore, matter is solid and without void.

**Book I., 511–519.**

Præterea quoniam genitis in rebus inanest,
Materiem circum solidam constare necessest,
Nec res ulla potest vera ratione probari
Corpore inane suo celare et que intus habere,
Si non, quod cohibet, solidum constare relinquas.
Id porro nil esse potest nisi materiæ
Concilium, quod inane queat rerum cohibere.
Materies igitur, solido quæ corpore constat,
Esse æterna potest, cum cetera dissoluantur.

*Translation.*

Furthermore, since there are empty spaces, or pores, in objects, solid matter must inclose them. Nor can anything be demonstrated, by strict argument, to have or to conceal void within its own body proper, unless you yield the point that this which incloses and contains it is solid.

But that which has the power of thus inclosing void in objects can be nothing less than an aggregation of matter.

Matter, moreover, which consists of solid substance, may be indestructible, while its derivative compounds are subject to dissolution.

**Book I., 520–531.**

Tum porro si nil esset quod inane vocaret,
Omne foret solidum; nisi contra corpora certa
Essent quæ loca complerent quæcumque tenerent,
Omne quod est, spatium vacuum constaret inane.
Alternis igitur nimirum corpus inani
Distinctumst quoniam nec plenum naviter extat
Nec porro vacuum. Sunt ergo corpora certa
Quæ spatium pleno possint distinguere inane.

Hæc neque dissolui plagis extrinsecus icta,
Possunt nec porro penitus penetrata retexi
Nec ratione queunt alia temptata labare;

*Translation.*

Still further, if there were nothing which we call void, the whole world would be solid.

On the other hand, unless there were substance to fill space and maintain all things which exist, empty void would prevail everywhere.

Matter therefore presents itself as distinct from void by antithesis and contrast; since the latter neither exists as wholly filled nor entirely empty.

There are present therefore certain primary bodies which are able to give demarcation to space and distinguish it as empty or full.

These bodies can neither be fractured by blows given them externally, nor dissolved by decomposition from within. Nor yet can their integrity be made to yield by any manner of assault upon them.

Book I., 540–551.

Præterea nisi materies æterna fuisset,
Antehac ad nilum penitus res quæque redissent
De niloque renata forent quæcumque videmus.
At quoniam supra docui nil posse creari
De nilo neque quod genitum est ad nil revocari,
Esse immortali primordia corpore debent,
Dissolui quo quæque supremo tempore possint,
Materies ut subpeditet rebus reparandis.
Sunt igitur solida primordia simplicitate
Nec ratione queunt alia servata per ævom
Ex infinito jam tempore res reparare.

*Translation.*

Unless, indeed, matter were thus indestructible, all things, before this, would have been reduced to nothingness; and we should behold whatever comes into existence created out of nothing.

But as I have demonstrated previously, nothing which is created ever arises from nothing; nor is any created thing ever resolved into nothing.

Hence the primordial bodies or germs of things must be of an indestructible character, in order that material may be supplied from the wasting away of objects, for the repair and renewal of the world.

It is argued, therefore, that the primordial particles (or atoms) are of intrinsic, pure solidity; since under no other supposition could they have served for the constant use and repair of the world through the infinite ages of the past.

**Book I., 551-565.**

Denique si nullam finem natura parasset
Frangendis rebus, jam corpora materiæ
Usque redacta ferent ævo frangente priore,
Ut nil ex illis acerto tempore posset
Conceptum summum ætatis pervadere ad auctum.
Nam quid vis citius dissolvi posse videmus
Quam rursus refici; qua propter longa diu
Infinita ætas anteacti temporis omnis
Quod fregisset adhuc disturbans dissoluensque,
Numquam relicuo reparari tempore posset.
At nunc nimirum frangendi reddita finis
Certa manet, quoniam refici rem quamque videmus
Et finita simul generatim tempora rebus
Stare, quibus possint ævi contingere florem.

*Translation.*

Otherwise, if nature had set no bound to the destruction of things, the primary particles of matter must long ere this have become so wasted, worn and broken from long use that no new thing could be produced from them in the allotted time of growth and increase, or attain its appointed size and dimensions.

For it is apparent that anything can be much more speedily demolished than constructed; and therefore, that which the vast ages of time past had broken and worn out, marring and wasting it away, would never be able to be restored in time for future use.

But it is evident that there have been set bounds and fixed limits to what may be destroyed, since we behold everything renewed with regularity, and at regularly appointed times in which everything, after its kind, reaches the full perfection of maturity.

**Book I., 565-577.**

Huc accedit uti, solidissima materiæ
Corpora cum constant, possit tamen, omnia, reddi,
Mollia quæ fiunt, aër aqua terra vapores,
Quo pacto fiant et qua vi quaeque gerantur,
Admixtum quoniam semel est in rebus inane.
Ac contra si mollia sint primordia rerum,

Unde queant validi silices ferrumque creari
Non poterit ratio reddi; nam funditus omnis
Principio fundamenti natura carebit.
Sunt igitur solida pollentia simplicitate
Quorum condenso magis omnia consiliatu
Artari possunt validasque ostendere viris.

*Translation.*

It follows therefore, although the primary particles of matter are quite solid, yet in order that objects composed from them may be soft, air, water, earth, vapors, for example, by whatever compact they exist, or by whatever power they may be maintained, void must be admixed in them.

But on the other hand, if the primordial particles are soft instead of solid, no reason can be rendered why flints and iron have been created as hard as we find them.

Nature, in fact, would be unable to have made a beginning or a foundation for her structures. The primary elements of things are therefore of a perfect solidity; and by the close combination of these elements objects are able to exhibit both strength and obduracy.

**Book I., 615-635.**

Præterea nisi erit minimum, parvissima quæque
Corpora constabunt ex partibus infinitis,
Quippe ubi dimidiæ partis pars semper habebit
Dimidiam partem nec res præfiniet ulla.
Ergo rerum inter summam minimamque quid escit?
Nil erit ut distet; nam quamvis funditus omnis
Summa sit infinita, tamen, parvissima quæ sunt,
Ex infinitis constabunt partibus aeque.
Quod quoniam ratio reclamat vera negatque
Credere posse animum, victus fateare necessest
Esse ea quæ nullis jam praedita partibus extent
Et minima constent natura. Quae quoniam sunt,
Illa quoque esse tibi solida atque aeterna fatendum.
Denique si minimas in partis cuncta resolvi
Cogere consuesset rerum natura creatrix,
Jam nil ex illis eadem reparare valeret
Propterea quia, quae nullis sunt partibus aucta,
Non possunt ea quae debet genitatis habere
Materies, varios conexus pondera plagas

Concursus motus, per quæ res quaeque geruntur.

*Translation.*

Moreover, unless there shall be some least limit or nether boundary, where the primordial particles of matter cease to be divided infinitely, these particles would each consist of infinite parts, since the half of a body would always have its half; nor would anything ever be limited or reach an end.

What therefore could be distinguished between the greatest and the smallest, between much and little?

There would be no difference. For although the universe as a whole may be of infinite extent, yet the least objects will equally consist of infinite parts.

Since strict reason precludes this and denies that the mind can admit it, the position must be taken that there are primary bodies, or particles of matter, which have no parts, but exist as the least possible in size and substance.

And since there are such indivisible bodies, you can but acknowledge, O Memmius, that they must be both solid and indestructible.

Furthermore, if Nature, the creator of all things, had not been in the habit of resolving objects into these minutest parts, she would never be able to renew the world from them; because those objects which are renewed by the addition of no such parts cannot be claimed to have those properties which generated bodies are known to possess, to wit, adhesion, weight, motion, and the power of giving and resisting blows; in a word, those properties which mark the behavior of matter under nature wherever observed.

**Book I, 951–968.**

Sed quoniam docui solidissima materiæ
Corpora perpetuo volitare invicta per ævum,
Nunc age, summæ quaedam sit finis eorum
Necne sit, evolamus; item quod inane repertumst
Seu locus ac spatium, res in quo quæque gerantur
Pervideamus utrum finitum funditus omne
Constet an immensum pateat vaste que profundum.
Omne quod est igitur nulla regione viarum
Finitumst; namque extremum debebat habere.
Extremum porro nullius posse videtur
Esse, nisi ultra sit quod finiat; ut videatur

Quo non longius haec sensus natura sequatur.
Nunc extra summam quoniam nil esse fatendum,
Non habet extremum, caret ergo fine modoque.
Nec refert quibus adsistas regionibus eius;
Usque adeo, quem quisque locum possedit, in omnis
Tantundem partis infinitum omne relinquit.

*Translation.*

But since I have taught that the primordial particles of matter are quite solid and fly hither and thither perpetually, unconquered and unworn by the ages, attend now, O Memmius, that we may demonstrate whether there is any end to their numbers or not.

Likewise, let us peer into that which has been found to be empty space, or void, in which Nature carries on her operations, and learn whether the foundations of it are limited by set bounds, or extend in vast, illimitable profundity.

It is evident, as I hold, that there exists no limit, no boundary, on any side, or in any direction; for if bounded, it must have some extreme point.

But it is apparent that there can be no extreme point of anything unless there be something conceived of beyond it, which thus sets limits to it.

In short, it would appear that the universe extends farther than any sense which we possess, enables us to follow.

Now since it must be conceded that nothing exists and extends beyond the entire universe, the latter can have no end; therefore it is beyond limit, or measure.

Nor does it matter in what region or tract of it one may stand, since in whatever place he takes his station, the whole remains equally boundless on every side.

### Book I., 968–984.

Præterea si jam finitum constituatur
Omne quod est spatium, siquis procurrat ad oras
Ultimus extremas jaciatque volatile telum,
Id validis utrum contortum viribus ire
Quo fuerit missum mavis longeque volare,
An prohibere aliquid censes obstareque posse?
Alterutrum fatearis enim sumasque necessest.
Quorum utrumque tibi effugium præcludit et omne
Coget ut exempta concedas fine patere.

Nam sive est aliquit quod probeat officiatque
Quominu' quo missum est veniat finique locet se,
Sive foras fertur, non est a fine profectum.
Hoc pacto sequar atque, oras ubicumque locaris
Extremas, quæram quid telo denique fiat.
Fiet uti nusquam possit consistere finis
Effugiumque fugæ prolatet copia semper.

### *Translation.*

Moreover, if all space be conceived of as having a boundary, and one were to run forward to the extreme confines of it, and were then to throw a swift dart, would you picture to yourself that dart, propelled with great force, as flying far forward in the direction it was cast?

Or would you rather be inclined to suppose that something would finally stop it?

For one or the other alternative you must of necessity adopt; but either one precludes escape to you from the conclusion that the universe stretches away without a bound.

For whether there is anything which may act to stay it in its flight that it may come to an end of it and become stationary, or whether it is borne onward continuously, it has not proceeded forward from a boundary.

And thence, on this supposition, I shall go on, and whenever you locate the farthest shores of space, I shall ask you what may happen in the case of the dart.

The outcome will be that an end of its flight can never be established, and that its escape will still find space in which to glide away.

### Book I., 988–996.

Praeterea spatium summæ totius omne
Undique si inclusum certis consistere ovis
Finitumque foret, jam copia materiae
Undique ponderibus solidis confluxet ad imum
Nec res ulla geri sub cæli tegmine posset
Nec foret omnino cælum neque lumina solis,
Quippe ubi materies omnis cumulata jaceret
Ex infinito jam tempore subsidendo.

*Translation.*

Besides, were the space of the entire universe included within fixed boundaries, the stores of matter would before this time have flowed together at the bottom of it, on account of its weight and solidity; nor could the operations of nature be carried on beneath the dome of heaven.

Indeed, there would be neither heaven nor light of day, since all matter, sinking down through infinite time, would be cast in one accumulated mass in the nether sphere.

**Book I., 1008–1012.**

Ipsa modum porro sibi rerum summa parare
Ne possit, natura tenet, quæ corpus inani
Et quod inane autem est finiri corpore cogit,
Ut sic alternis infinita omnia reddat.

*Translation.*

Nature also takes care of her own accord, that the totality of things shall not be thus amassed upon itself, but sees to it that void shall invest matter and matter divide void, in order that by such alternations the universe may be rendered infinite in extent and variety.

**Book I., 1021–1028.**

Nam certe neque consilio primordia rerum
Ordine se suo quæque sagaci mente locarunt
Nec quos quæque darent motus pepigere profecto,
Sed quia multa modis multis mutata per omne
Ex infinito vexantur percita plagis
Omne genus motus ex coetus experiundo.

*Translation.*

For assuredly the primordial elements or atoms neither arranged themselves in their places by virtue of any plan or mental sagacity of their own, nor yet moved forth from a previously concerted agreement.

But because they are changed in their courses and acted on in many ways throughout the extent of cosmos, agitated and vexed by blows from eternity, they have, after experiencing every possible vicissitude, obtained such aspects and conditions as we now see that nature presents.